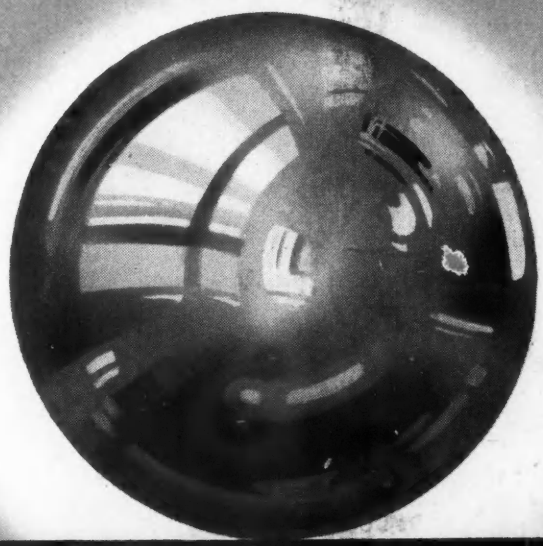
Automotive and Aviation Industries

Engineering Library

JUNE 1, 1947

UNIV. OF MINNESOTA
RECEIVED
JUN 10 '47



High Ball for Industry

Engineering Library

In the old days, on the railroads, a ball was used to signal the trains. A high ball meant "Clear track—full speed ahead."

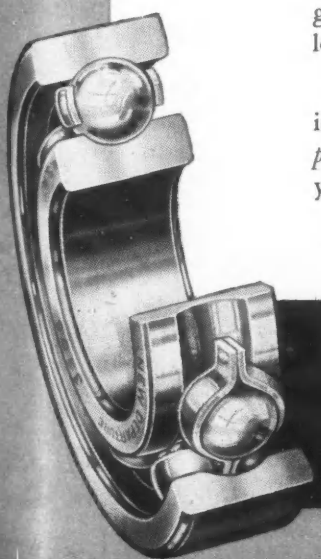
Today, other balls give the go ahead sign—this time, to industry. We speak of the tough, forged steel balls in New Departure ball bearings.

Because these famous precision-made bearings are ball bearings, they give industry many advantages. New Departure ball bearings take heavy loads from *any direction* with a single bearing.

They support parts mounted in any position—hold them permanently in place with extreme accuracy. They permit higher speeds and *faster production*. They say—to all of industry—"Full speed ahead." Write for your copy of the free booklet, "Why Anti-Friction Bearings."

nothing rolls like a ball

464-R



NEW DEPARTURE
***forged steel* BALL BEARINGS**

NEW DEPARTURE • DIVISION OF GENERAL MOTORS—BRISTOL, CONN. • Branches in DETROIT • CHICAGO • Other principal cities

DO CUTTING OIL PROBLEMS HAVE YOU TREED?

YOU CAN GET DOWN-TO-EARTH HELP FROM . . .

Standard's CUTTING OIL SERVICE

TAP BREAKAGE . . . tool burning . . . wheel loading . . . poor die life . . . there seems to be no end to problems that arise when tooling up on the production line for a new product or new parts.

That's why Standard Oil, a number of years ago, decided that supplying cost-saving cutting oils was only part of its job. To help plant men correctly apply these cutting oils, trained specialists also were needed—specialists who knew all the available cutting oils and the types of jobs for which each was best fitted.

This know-how gives extra assurance of good results from Standard's Cutting Oil Service. If your plant is in the Midwest, you can get this service simply by calling the nearest Standard Oil office or by writing 910 South Michigan Avenue, Chicago 80, Illinois. Then put your problem up to the Cutting Oil Specialist who calls.

STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly | June 1, 1947 | Vol. 96, No. 11

JULIAN CHASE, Vice-Pres. and Directing Editor

J. R. CUSTER, Associate Editor
JEROME H. FARRIS, Ass't Editor
MARCUS AINSWORTH, Statistician
W. T. BOSTELMAN, News Editor
JOHN C. HILDRETH, JR., Research
L. W. MOFFETT, Washington Editor
E. J. HARDY, Washington News Ed.
JOS. GESCHELIN, Detroit Editor
H. H. ROBERTS, Ass't Editor
ROBERT C. MACK, Engineering Editor
LEONARD WESTRATE, News Editor, Detroit
HOWARD KOHLBRENNER, Art Editor
KARL RANNELS, Washington News Ed.
R. RAYMOND KAY, Pacific Coast Editor

CONTENTS

News of the Industry 17
New Cars in the Indianapolis Race. *By Robert T. Jackson* 24
Automotive Generators 31
Rolls Royce 3500-Hp. Engine. *By W. F. Bradley*.... 32
A New Approach to the Torquemeter Problem. *By K. W. Miller* 36
Unique Machinery Facilitates Production of Body Hardware. *By Joseph Geschelin* 38
Torque Measuring Device Utilizes Compressed Air.. 41
Autocar Installs Special Machines for Boring Crankcases 42
New Production and Plant Equipment..... 43
New Forging Developments at Oldsmoble Plant.... 46
"Liquid Springing" for Motor Vehicles 47
New Products 48
Magnaflux Machine Permits Continuous Inspection of Heavy-Duty Crankshafts 52
A Diesel for the Volkswagon 54
Connecting Rod Honing Machine 56
Personals 58
Publications Available 60
Calendar of Coming Events 68
Advertisers' Index 128

Copyright 1947 by Chilton Company (Inc.)

G. C. BUZBY, President and Manager Automotive Division
E. H. MILLER, Adv. Mgr. E. W. HEVNER, Cir. Mgr.
JOHN CLEARY, Promotion Mgr.

REGIONAL BUSINESS MANAGERS

JOHN T. HOOLE, Chicago
E. E. ELDER, Detroit
NELSON W. SIEBER, Philadelphia
HARLAND E. BOYD, Cleveland
A. R. ECKEL, New York
C. H. WOOLLEY, San Francisco
AUGUST HAURIN, JR., Los Angeles

OFFICES

Philadelphia 39, Pa., Chestnut & 56th Sts., Phone SHerwood 7-1424
New York 17, N. Y., 100 East 42nd St., Phone Murray Hill 5-8600; Chicago 1, Ill., Room 916, London Guarantee & Accident Building, Phone Franklin 4243; Detroit 2, Mich., 1015 Stephenson Bldg., Phone Madison 2090; Cleveland 14, Ohio, 1030 Guardian Bldg., Phone Cherry 4188; Washington 4, D. C., 1061 National Press Bldg., Phone District 8109 and 8110; San Francisco 5, Calif., 605 Market St., Room 608, Phone Sutter 4951; Los Angeles 1, Calif., 6000 Miramonte Blvd., Phone Lafayette 5525.

Cable Address .....Autoland, Philadelphia

Member: Audit Bureau of Circulations; Associated Business Papers, Inc.

AUTOMOTIVE *and* AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY (INC.)

Executive Offices
Chestnut and 56th Streets, Philadelphia 39, Pa., U. S. A.

Officers and Directors
JOS. S. HILDRETH, *President*

Vice-Presidents

EVERIT B. TERHUNE — P. M. FAHRENDORF — JULIAN CHASE
THOMAS L. KANE — G. C. BUZBY — CHARLES J. HEALE
WILLIAM A. BARBER, *Treasurer* — JOHN BLAIR MOFFETT, *Secretary*
HARRY V. DUFFY — T. W. LIPPERT — FRED V. COLE

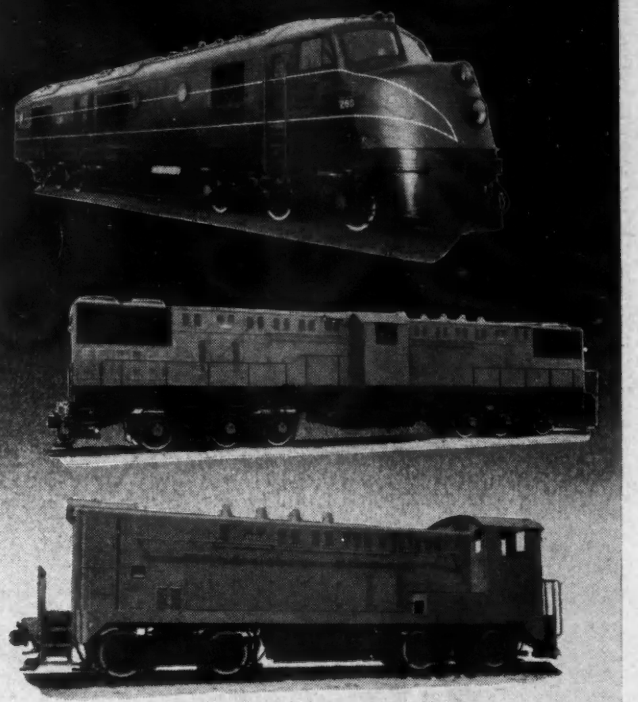
WILLIAM H. VALLAR, *Asst. Treas.*

PAUL WOOTON, *Washington Member of the Editorial Board*

BALDWIN CHOOSES

YOUNG

TO COOL ALL THREE TYPES



● Flashing, streamlined passenger engines, rugged road and transfer locomotives, versatile switchers . . . all three types built by Baldwin . . . are cooled by Young. Since the introduction of the diesel-electric locomotive twelve years ago, these powerful units have been constantly in the news. First, it was transcontinental speed records; but now it's the economy and dependability records that are showing up convincingly on railroad ledgers. Young is proud to be a contributor in this accomplishment. Young-Quality Heat Transfer Products will be found giving efficient, economical service on all kinds of internal combustion engines, from small portable power units to huge diesel generating plants. You can benefit from referring your heat transfer problems (whatever they may be) to Young.

YOUNG

HEAT TRANSFER PRODUCTS

OIL COOLERS • GAS, GASOLINE, DIESEL ENGINE COOLING RADIATORS • HEAT EXCHANGERS
INTERCOOLERS • EVAPORATIVE COOLERS — ENGINE JACKET WATER COOLERS
GAS COOLERS • UNIT HEATERS — CONVECTORS • CONDENSERS • AIR
CONDITIONING UNITS • EVAPORATORS — HEATING COILS • COOLING COILS
AND A COMPLETE LINE OF AIRCRAFT HEAT TRANSFER EQUIPMENT

YOUNG RADIATOR CO., Dept. 217-F RACINE, WIS., U.S.A.

AUTOMOTIVE *and* AVIATION INDUSTRIES. Vol. 96, No. 11. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription rates: United States, Mexico, United States Possessions, and all Latin-American countries, $2.00 per year. Canadian and Foreign $5.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

Grind more pieces PER WHEEL DRESSING

AN EFFECTIVE grinding coolant must 1) settle grinding dirt quickly, and 2) prevent rust. Emulsions prepared with *Texaco Soluble Oil D* (or, where water is particularly hard, with *Texaco Soluble Oil HW*) have these two essential characteristics.

Quick settling of grinding dirt from *Texaco Soluble Oil D* emulsions prevents wheel loading and means increased production and lower operating costs. You can grind faster and smoother, get more pieces between wheel dressings and wheels last longer.

Emulsions with *Texaco Soluble Oil D* cool the work quickly, preventing distortion from frictional heat, and they leave the finely finished surface filmed with oil, thus effectively preventing rust.

You'll do more and better work with the help of Texaco Products and Lubrication Engineering Service. Call the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

PREVENT SLUDGE AND RUST IN HYDRAULIC SYSTEMS

Users everywhere report smoother, more dependable hydraulic operation with *Texaco Regal Oils (R & O)*. These turbine-grade oils are specially processed to prevent foaming and contain inhibitors to prevent the rust and sludge formations that cause costly hydraulic stoppages.

TEXACO

TEXACO CUTTING, SOLUBLE AND GRINDING OILS FOR FASTER MACHINING

Tune in... TEXACO STAR THEATRE presents the NEW TONY MARTIN SHOW every Sunday night. See newspaper for time and station.

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the first and 15th of the month

June 1, 1947
Volume 96, No. 11

Some High Spots of this Issue

Highlights of New Design Features in the Indianapolis Races

Details of the compact, high-output engines of four, six, eight, twelve and sixteen cylinders. Unique suspension systems with torsion bars predominating. Drawings and photographic illustrations of transmissions, power plants and comprehensive chassis layouts. Starts on page 24.

Body Hardware Produced by Unique Methods at Ternstedt

Straight line manufacturing for each type of product provided by overall plant layout and the utilization of highly specialized fabrication and polishing machinery including forming mills for stainless steel fitted with automatic polishing attachments. See page 38.

Something New in Torquemeters

A magnetostrictive device which measures both average and instantaneous values of crankshaft torque by detecting magnetic and electrical changes due to torsional stress in material of shaft surface. Turn to page 36.

The 3500 hp Eagle Engine by Rolls Royce

England's most powerful piston-type engine which has 24 cylinders and is of horizontal H design with a piston displacement of 2810 cu in. It is liquid cooled and has sleeve valves, a two-speed, two-stage centrifugal intercooled and aftercooled supercharger. Completely described and fully illustrated, beginning on page 32.

A Versatile Crankcase Boring Machine

It can be arranged to rough finish, semi-finish or finish bore holes for seven main bearings, five camshaft bearings, one idler shaft, one accessory shaft and one generator, holding close tolerances on bore centers. See page 42.

30 Items of New Production Equipment and New Products And Other High Spots Such As:

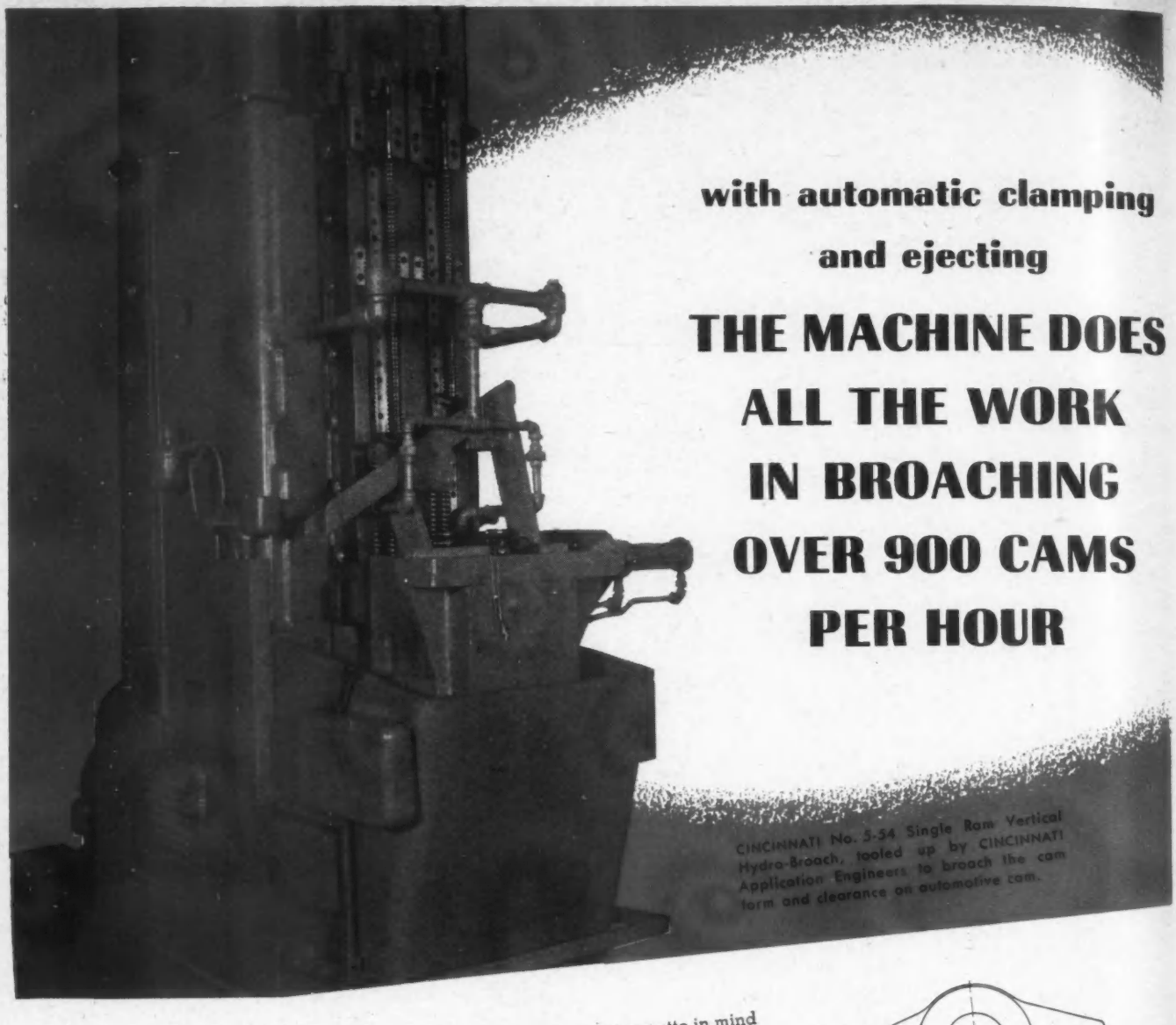
Automotive Generators Adaptable for Personal Aircraft; A Torque Measuring Device that Utilizes Compressed Air; Forging Developments at Oldsmobile Plant; and Liquid Springing for Motor Vehicles.

Comprehensive Interpretation of Industry News, Page 17

For Complete Table of Contents See Page 3

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.



CINCINNATI No. 5-54 Single Ram Vertical Hydro-Broach, tooled up by CINCINNATI Application Engineers to broach the cam form and clearance on automotive cam.

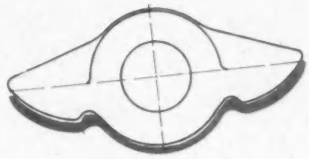
with automatic clamping and ejecting

THE MACHINE DOES ALL THE WORK IN BROACHING OVER 900 CAMS PER HOUR

• All work and no play . . . for the machine . . . must have been the motto in mind when Cincinnati Application Engineers developed the equipment shown here. It's a CINCINNATI No. 5-54 Single Ram Vertical Hydro-Broach with an air-operated fixture which automatically loads and clamps four parts at one time (two stacks of two). ¶The operator places four parts on the fixture, and the remainder of the operation is automatic. At the top of the stroke a pusher moves the work to the edge of the fixture, where the pieces drop into position on tapered pins and are pneumatically clamped when the ram descends. On the upward stroke, an automatic ejector device on the ram picks up the finished parts and carries them down again part way where they are injected into a chute.

The ram cycle proceeds continuously, broaching 970 cams per hour.

This equipment is typical of the work of Cincinnati Application Engineers in selecting the right machine and tooling it up for low-cost production. These men are ready to give you the benefit of their many years' experience in surface broaching. Contact the nearest field engineering office.



Drawing of the cam broached on the equipment illustrated here. Colored lines indicate broached surface. Production is 970 cams per hour.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES

Direct field engineering offices: Boston 16, Massachusetts; Buffalo 7, New York; Chicago 12, Illinois; Cincinnati 9, Ohio; Cleveland 3, Ohio; Detroit 2, Michigan; New York 17, New York; Philadelphia 40, Pennsylvania; Pittsburgh 22, Pennsylvania; Syracuse 2, New York; West Hartford 7, Connecticut.

NEWS of the Industry

Steel Outlook Bleak; Production Lower

The automobile industry found out in early May that robbing Peter to pay Paul could not go on indefinitely. The relatively high volume of production during March and April was obtained by dipping into sheet steel inventories in the hope that deliveries would improve to the point that a continued high production would be possible. That did not materialize and, in addition, the one week strike at Inland Steel hit very heavily so that the inevitable result was a production cutback in May. Nash was forced to reduce its schedules 30 per cent. Briggs closed its body operations for 11 days forcing Chrysler to close its final assembly lines from May 10 to May 20. Various Fisher Body plants also were affected for shorter periods requiring some short working weeks at GM Divisions. It now appears quite likely that official production figures will show May to be the lowest production month this year. An improved sheet steel supply is not anticipated until mid-summer at the earliest. Actually, no one is looking for any real all out peak production until the last quarter of this year when new sheet steel mills are expected to be brought into operation.

Replacement Part Makers See Orderly Adjustment

Automotive replacement parts companies report that the trade is becoming definitely price conscious. They say they see a definite trend toward buying in small lots in anticipation of a possible future price lowering. The large, well-established parts makers are not particularly worried about the situation since they see a rather slow and orderly adjustment ahead rather than a sudden price break. They believe that the market potential is tremendous with the number of cars on the road closely approaching the pre-war figure, with a much larger percentage than normal being older vehicles. One factor that has tightened competition somewhat in the replacement parts field is that the original equipment demand has not been up to expectations because of production troubles at the vehicle manufacturing level, leaving considerable capacity available for manufacture of replacement parts.

Light Chevrolet Must Wait

Production of a new lightweight Chevrolet has been deferred indefinitely by General Motors Corp. because of a shortage of materials for both cars and new plants. GM feels that because of the strong demand for present models, it would be unwise to divert materials for a new automobile.

It is known that GM had pretty well set the design of the proposed car, which is said to be noticeably smaller overall than the conventional models. Inside dimensions, however, are reported to be pretty well in line, which would indicate a swing to the wider body styling. Mechanical features are clouded in secrecy, although the engine is known to be quite small. A source close to GM reports that a rigid cost accounting had been made on every piece going into the car and on certain possible changes that might be made, so that the exact cost is known. He estimated that a recent report stating the car would be built for about $200 under the present Chevrolet was "about right." He added that simplification of parts in order to reduce the number of pieces and to lower production costs has been carried out intensively throughout the project. The cost of building, tooling, and other expense of getting into production has been estimated at close to $100 million.

Packard Raises Prices After First Quarter Loss

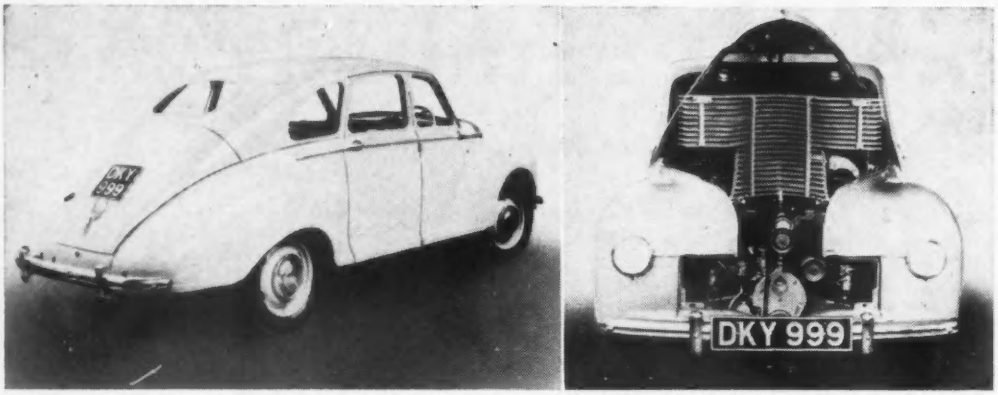
Most serious effect of the sheet steel shortage apparently has been felt by Packard Motor Car Co. George T. Christopher, president, reported a consolidated net loss for the first three months of this year of $1.148 million. The loss probably will be reduced through effect of a possible tax carry-back refund which cannot be determined at this time. Principal reason for the loss was

The Jeep Family Has a New Member

This steel panel light delivery truck is the latest in the Willys-Overland line of utility vehicles. Powered by the Jeep engine, the all-steel body rests on the same chassis as the Jeep Station Wagon. With a gross vehicle weight of 3875 lb and carrying a 1050 lb payload, the delivery truck features independent front wheel suspension and has a maximum speed of 66 mph

NEWS of the INDUSTRY

New Jowett Javelin



The new 1½ liter Jowett Javelin features an all-steel integral body and sub-frame construction with a flat four engine and a 102 in. wheelbase. Overall height of 5 ft, ½ in., width of 5 ft, 1 in. and length of 14 ft give the new Javelin clean lines. With alligator bonnet raised, and the grille hinged up, accessibility of the engine for minor adjustments is exceptionally good. The bonnet is locked from the inside of the car.

low volume production for the quarter, in which the company was able to operate only 28 of the 63 working days in the period. Production was 11,710 cars, compared to the 17,800 originally scheduled, and was under the total for the last quarter of 1946.

Immediately following the report the company increased its prices on all models from $75 to $224, the second price increase this year. On January 7, Packard raised prices a weighted average of $62 a car. At that time it was stated that the company still expected to show a loss of $80 per unit. The new price increase takes into consideration an expected wage increase of about 15 cents an hour as well as higher material costs which the company has not been able to absorb at current limited production levels. Packard says it stood to lose more than $2 million on 1947 models if prices were not increased.

DELIVERED PRICE AT FACTORY INCLUDING FEDERAL TAXES

	New Price	Old Price	Increase
SIX			
Touring Sedan ..	$1,845	$1,745	$100
Club Sedan	1,820	1,695	125
DE LUXE EIGHT			
Touring Sedan ..	2,047	1,947	100
Club Sedan	2,022	1,895	127
SUPER EIGHT			
Touring Sedan ..	2,591	2,391	200
Club Sedan	2,566	2,342	224
CUSTOM SUPER EIGHT			
Touring Sedan ..	3,349	3,274	75
Club Sedan	3,284	3,140	144
LIMOUSINE			
Touring Sedan ..	4,668	4,521	147
7-Passenger	4,504	4,357	147

Chrysler Expands in Mexico

As part of the large expansion and modernization program of the Chrysler assembly plant, Fabricas "Auto-Mex", at Mexico, D.F., two railroad tracks accommodating four trains of five freight cars each have been built into the factory. All of the material required to build a total of 64 cars and trucks is contained on each five-car train.

Willys-Overland Introduces 4-Wheel Drive Jeep Truck

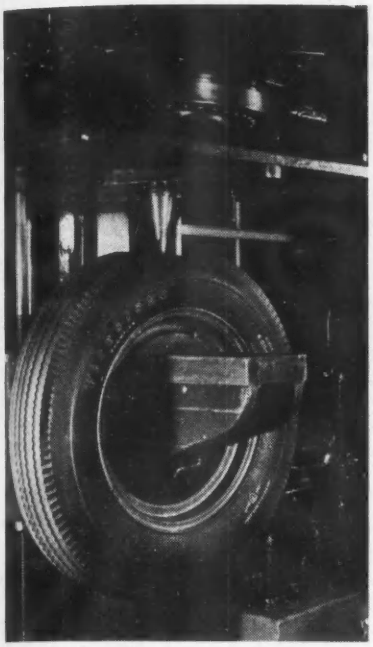
To round out its utility line, Willys-Overland Motors, Inc., has introduced the 4 x 4T four-wheel drive general purpose truck to supplement the 4 x 2T described in the May 15, 1947, issue of AUTOMOTIVE AND AVIATION INDUSTRIES. This model mounted on a 118 in. wheelbase chassis is rated 5300 lb gvw and carries a payload of 2000 lb. It comes in the same body styles as the 4 x 2T and has the same features of interchangeability and mechanical design, except for the differences required for four-wheel drive.

The front axle, supplied by Spicer, is of hypoid full-floating, driving and steering type with a gear ratio of 5.38 to 1 and spring centers underslung for clearance. It has the same basic parts as the Jeep front axle. The front propeller shaft is of tubular type with Spicer needle bearing universal joints. The rear axle is the same as on the 4 x 2T, except that only one ratio is available—5.38 to 1.

A three-speed Warner gear transmission is used in connection with a Spicer transfer case which has a normal ratio of 1 to 1 and 2.43 to 1 for underdrive. There are two control levers, one for shifting the range gears, the other for declutching the front axle. The latter is provided with an interlock to prevent the use of low range gearing when front drive is disengaged. A power take-off also is provided. Since lubricant level in the transfer case is lower than in the transmission, special provision is made for circulating lubricant through the entire gear train. For this purpose, the pair of gears connecting the transmission and transfer case are made to serve as a positive gear pump. Oil is

NEWS of the INDUSTRY

To Test, It Rams



This hydraulic test machine rams the cone-shaped plunger into tires to test their resistance to severe road shocks in the Firestone Tire and Rubber Co. laboratories.

pumped under pressure through a hole in the transmission case wall which is also provided with relief holes and an overflow level hole.

Packard Announces Plans For Automatic Transmission

It now seems likely that Packard Motor Car Co. will have a new automatic transmission available for introduction on its 1948 model cars. In a report to stockholders, George T. Christopher, president, stated that development work has been carried forward on a new automatic transmission for the past two years and that present plans calls for it to go into production during 1947. A current report states that the company has asked suppliers for commitments on automatic transmission parts in a volume estimated at 7000 a month and that production would be starting soon. Another manufacturer of a higher priced car is reported to have parts for an automatic transmission going through production stages.

No '48 Pontiacs This Year

First hints of 1948 model plans by any General Motors Corp. division were made on a negative note by Harry J. Klingler, general manager of Pontiac Div., when he stated recently that Pontiac will not change over to 1948 models this year. He said that demand was so great that his division will confine all its efforts to producing as many passenger cars as possible without interruption. It will be remembered that GM several months ago scrapped its 1948 dies for Chevrolet, Pontiac, and Oldsmobile models, at least in one body style. It is reported that Buick also does not plan to change to its '48 model this Fall. Another report dealing with new models is that steel companies say that at least three manufacturers have received specifications for steel for 1948 models. One of the companies indicated it wanted delivery in the third quarter and the others were for fourth quarter delivery.

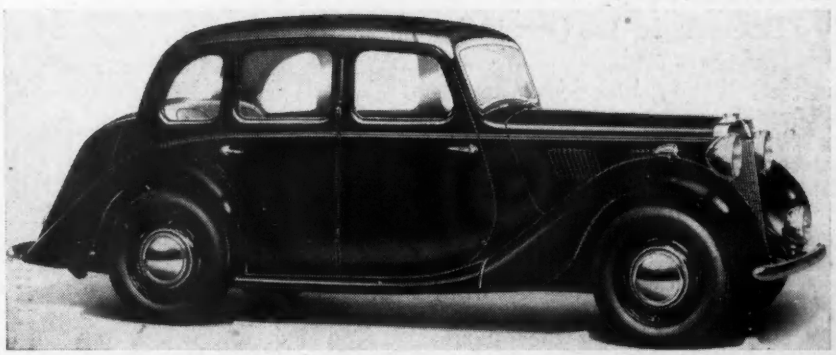
May Use Aluminum for Steel Replacement Parts

A large automotive manufacturer is said to be considering the use of sheet aluminum for replacement parts normally made from sheet steel. Very little is known about the progress of development but the company is reported to be prompted by the following considerations. Steel is unobtainable in suitable quality for replacement parts in view of the tremendous quantities demanded by original equipment. Certain nonfunctional parts which are bulky in nature might normally lie around a long time. Under such conditions, sheet aluminum parts would need no particular treatment but could be stored until ready for painting and use. In addition, they would be extremely light in weight which would result in lighter crating and could be top loaded with a shipment of heavy parts to branches at a considerable saving in freight cost. It would be necessary to insulate at points of attachment between aluminum and steel parts in order to prevent electrolytic action. The possibility of sheet aluminum parts offers some interesting speculation, but there is no definite information as to whether or not they can compete from a cost basis and whether they ultimately may be adopted.

Low Cost Car Calls for Many New Techniques

With no major manufacturer apparently anywhere near ready to enter the market with a light, low cost automobile, comments of a Detroit engineer on what probably would have to be done to make such a car a practical market possibility are interesting. He points out that in the first place the manufacturer would have to find some material in which the weight, strength, and cost ratio offers something better than now available. Another factor would be simplification of parts to reduce the total number of pieces required. He suggests such developments as greater use of die castings and designing of parts that can be built in one piece instead of several—such as the trend now to include the fender and rear body panel in one piece. Another possible cost saving would be to reduce the number of operations on each piece by casting or forging to approximately the final size and also to reduce the finishing operations to a minimum. He believes another big improvement could be made in reducing to a minimum

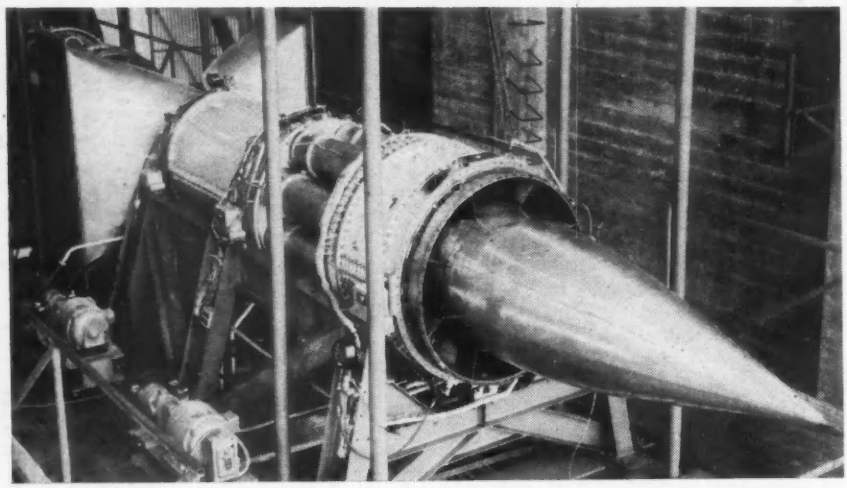
The New MG Sedan



A Nuffield product, the new MG sedan is powered by a four cylinder 46 hp engine and features an independent suspension in front of the double wishbone type with coil spring. With a 99 in. wheelbase, the new MG is 13 ft, 5 in. long; 4 ft, 9 in. high; and 4 ft, 10¼ in. wide, and the standard model is a four seater sedan with individual front seats weighing 2262 lb. Without purchase tax, the car is price tagged in England at £525.

NEWS of the INDUSTRY

The Turbodyne for High-Powered Army Bombers



This photograph of the Turbodyne, the new 10,000 hp gas turbine developed by Northrop-Hendy, has just been released by the Army. Engine horsepower is delivered on a shaft with an additional jet thrust of approximately 600 lb obtainable. Designed and built for the Northrop B-35 Flying Wing under an Army contract, the Turbodyne has varied commercial use especially where great power is required within a limited space.

the handling and processing of parts and assembly units using the least expensive devices—such as gravity roller conveyors rather than motor driven equipment. Other cost reduction factors he mentions are greater use of transfer machines to reduce the number of times each man must handle and position a piece accurately and the greatest possible simplification in final assembly operations. He admits that all companies are working continually on these problems but believes that the one that makes the greatest progress in combining these factors in one operation stands the best chance of producing a really low priced automobile that will be acceptable to the public.

U.S. Tire Industry Broke Two Records in 1st Qtr. '47

The American tire industry outdid itself in the double record breaking first quarter of 1947 by producing 20,356,719 passenger cars and motorcycle tires, and 4,709,537 truck and bus tires, according to the Office of Materials Distribution, Department of Commerce. For the last quarter of 1946 the comparable figures were 19,030,059 and 4,364,712. Production of 1,367,353 tractor and implement tires during the quarter also exceeded production in any similar period.

A detailed picture of the U. S. tire industry's record breaking first quarter is given in estimated shipment and production figures supplied by the Rubber Manufacturers' Association, Inc. These cover only automotive casings and tubes, however, and do not include either solid rubber tires or pneumatic tires for farm and aviation equipment, motorcycles and bicycles:

	First Quarter	
TOTAL AUTOMOTIVE CASINGS	**1947**	**1946**
Original Equipment Shipments	6,516,761	1,781,643
Replacement Shipments	15,522,550	15,634,311
Export Shipments	711,149	287,943
Total Shipments	22,750,460	17,703,897
Production	25,000,493	18,459,245
Inventory End of Month	4,515,502	3,487,263
PASSENGER AND TRUCK AND BUS TUBES		
Original Equipment Shipments	6,510,576	1,769,696
Replacement Shipments	12,814,421	12,199,711
Export Shipments	617,882	268,666
Total Shipments	19,942,879	14,238,073
Production	24,481,266	15,355,998
Inventory End of Month	8,049,894	4,444,649

K-F Stock Increase— First Profit Shown in May

Stockholders of the Kaiser-Frazer Corp. recently approved at the annual meeting an increase in authorized capital stock from five to eight million shares of $1 par value, and, in addition, authorized one million shares of preferred stock without par value. At present, sale or issuance of this stock is not contemplated. Joseph W. Frazer, president, said that the company had "turned the corner," and in May, for the first time, showed a profit. At the current production rate, May schedules calling for 11,000 automobiles should not only be met, but possibly surpassed. From May 1 to 19, K-F has shipped 6577 cars.

MEMA Survey Shows Jobbers in Sound Position

Automotive jobbers are in a basically healthy condition, the Motor and Equipment Manufacturers Association Jobbers Survey for 1945-46 of 387 wholesalers' financial statements reveals. Sales show a 49 per cent increase and inventories 53 per cent in 1946 over 1945, accounted for in part by the increase in prices in 1946. Payables show a 65 per cent increase. The Gross Profit on Sales was unchanged in 1946, remaining exactly at 28.4 per cent; however, the New Profit on Sales jumped from 4.6 per cent in 1945 to 5.2 per cent in 1946, indicating that the greater volume handled offset higher expenses.

High liquidity is indicated in a satisfactory current ratio of 2.6 in 1946, which, however, is a drop from 3.1 in 1945. Since reports of profits are not shown on a uniform basis and as the survey includes corporations, partnerships, and proprietorships, the Net Profit figure cannot be taken as a true index.

Giant Bus by Twin Coach

The Twin Coach Co. of Buffalo has unveiled a city-type bus with a capacity of 120 passengers including standees, reportedly the world's largest. Production of the new bus is scheduled to get underway this fall.

Chrysler Div. Eliminates Sales Force Distributors

Chrysler Div. of Chrysler Corp. has joined the growing list of automobile companies that have eliminated distributors from their sales setup. Henceforth, all retail outlets in the U. S. will be in the form of direct dealers. The move started before the war and was accelerated during the postwar period in order to meet the competitive period ahead. Only Cadillac, Hudson, Kaiser-Frazer, DeSoto, and Willys use the distributor system at present. The trend to direct dealerships in the automobile industry has been very marked in recent years. Manufacturers believe that they themselves can perform the functions normally contributed by distributors, and that the over-ride can better be used for

financing field operations and possibly for giving the dealer a better deal.

One-Sixth of U.S. Business Classified As Automotive

Figures compiled by AMA for its forthcoming issue of Automobile Facts show that one out of every six business concerns in the U. S. are classified as automotive. The grand total of 534,470 is composed of 1360 manufacturing; 42,255 in wholesale trade; 307,375 in retail trade; 79,744 service establishments; 66,366 in transportation and 37,370 miscellaneous related enterprises. Although many thousands of raw materials and component parts producers count the motor vehicle industry as a principal customer, they are not included in the total since a satisfactory count of these suppliers is not available.

Adam Opel Back in World Market

Adam Opel A. G., General Motors Corp. owned subsidiary in Germany, has taken its first tentative step back into world trade. A contract for $500,000 has been signed with the Joint Anglo-American Export-Import Agency as seller and the General Motors Overseas Corp. which will start the flow of spare parts for Opel cars to Denmark, Switzerland, Belgium, Holland, and Sweden. The U. S. Military Government now has property control of Opel, and the Export-Import Agency controls its exports.

Versatile New Beechcraft

The new Model 34 Beechcraft is expected to be flown in June for the first time. Versatility is stressed in the plane which has been designed specifically as a short haul airplane. Cargo space in addition to the ample cargo compartment between the passenger and pilot compartments is obtained by conversion of the forward section of the passenger compartment. A movable bulkhead complete with door is provided so that in any varying adjustment, passengers will be completely segregated from the cargo.

Designed to carry 20 people, their baggage and about 1000 lb of air mail or express as a short haul carrier, the Model 34 Beechcraft, in addition, has fuel capacity for a maximum range of 1400 miles with a 45 minute reserve.

Production of Cars & Trucks*

(U. S. and Canada)

Weed ending	1947	Corresponding Week in 1941
Jan. 4	53,437	76,690
11	64,828	115,935
18	75,166	124,025
25	93,278	121,948
Feb. 1	94,114	124,400
8	89,958	127,675
15	97,276	127,510
22	103,400	127,740
Mar. 1	105,175	126,550
8	104,048	125,915
15	105,493	131,410
22	108,472	123,805
29	100,355	124,165
Apr. 5	97,335	116,255
12	97,893	99,260
19	105,337	99,945
26	102,447	108,165
May 3	101,690	130,610
10	94,756	132,380
17	82,881	127,255
Total	1,877,392	2,391,638

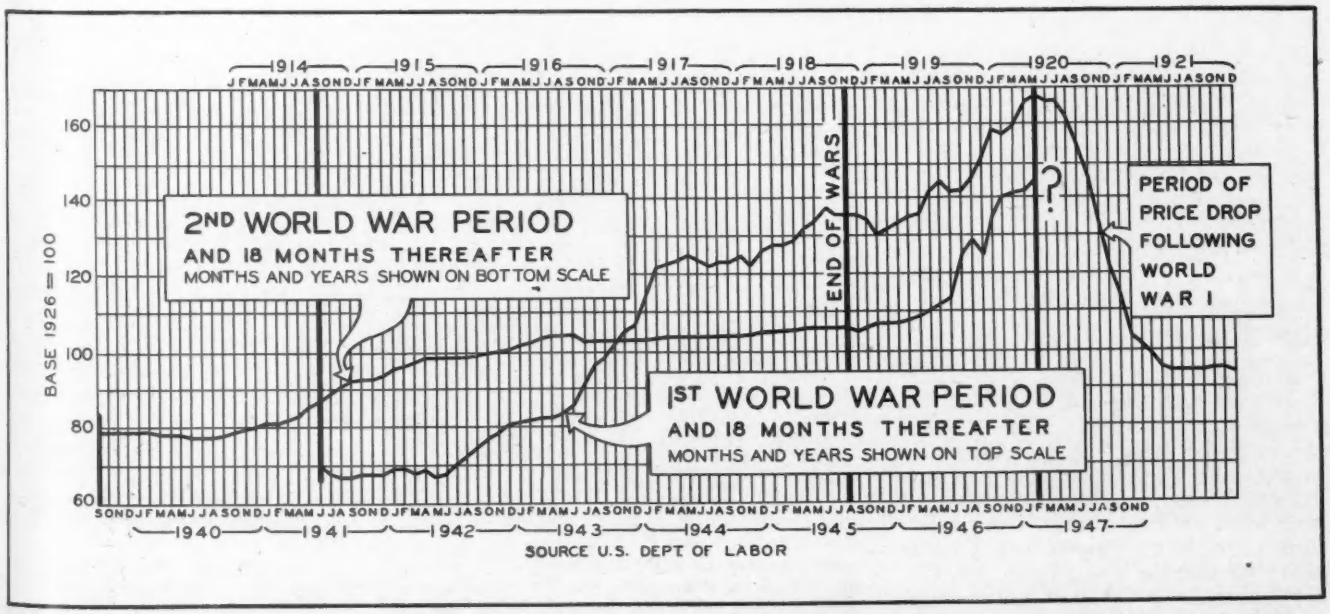
* Compiled by Ward's Automotive Reports.

GM Completes Testing Australian Light Car

A report from Australia says that General Motors Corp. has completed durability tests on four of the light model cars it plans to build in that country. However, production is not scheduled to get started until July or August with full output coming sometime in 1948. The report says

Prices in the United States During and After Two World Wars

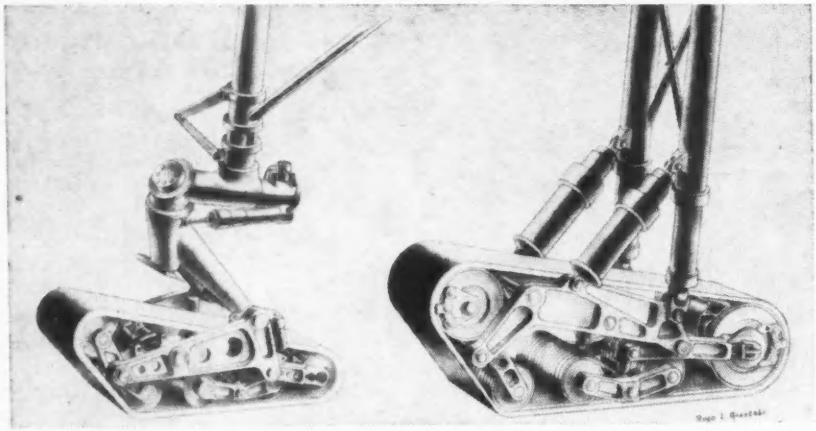
Indices of Wholesale Prices All Commodities



With 1926 as a basis of comparison, the index for wholesale prices of all commodities was lower by 22.6 points 18 months after the end of World War II than it was at the corresponding time after World War I. A marked drop followed the peak in 1920. The question now is what will happen from here on?

NEWS of the INDUSTRY

Fairchild Packets Get Flying Runways



Soon to be installed on the Fairchild C-82 Packet are these track-type landing gears. The wide rubber belt decreases ground bearing pressures from 60 to 20 psi, and the rotating cylinders absorb the initial shock of landing, eliminating the need for surfaced runways for heavy aircraft. A complete tricycle installation, the nose gear has a 14 in. wide tracked surface, and each main gear has a 19 in. wide surface, all three retracting in the same way as conventional wheel gear.

further that strikes and inability to get workmen to give a full day's work are hampering production plants.

New Model Tooling Costs Much Heavier Than Prewar

Automotive manufacturers, now getting into 1948 tooling programs in earnest, are staggering a bit under the impact of costs which have gone up two to three times over prewar levels. One company is reported to have gagged so violently over figures brought in by its master mechanics department that it twice threw the estimates back as entirely unacceptable. Before the war, the cost of tooling had been running about $20 million. The costs of 1948 work was projected at about $50 million. It is not known whether the cost was scaled down any, but at least the company now is going ahead with die work.

Fisher at Van Nuys Making Chevrolet Bodies by Sept.

General Motors Corp.'s new Fisher Body Div. plant at Van Nuys, Calif., will be producing Chevrolet truck and passenger car bodies, except the convertible model, for the adjacent Chevrolet plant by September 1, barring steel shortage interference, according to A. P. Clausen, plant manager. Employing 800 people, the Van Nuys Fisher plant will have a capacity about the same as Fisher plants now operating in St. Louis and Kansas City.

1st Qtr. Dividends Up 23%— Car Dividends, 2%

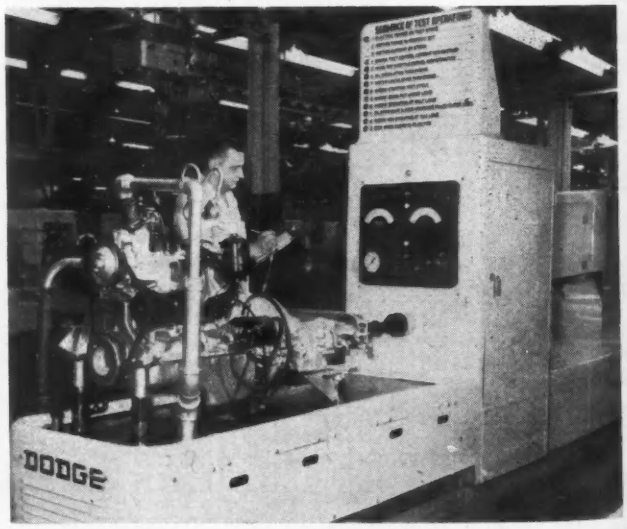
Dividend payments, a sensitive indicator on the business barometer, showed a healthy 23 per cent rise in the first quarter of 1947 over 1946. Of the 942 equity issues listed, over 70 per cent, or 661, paid $674 million in the first quarter of 1947 as against 626 paying $548 million in the first quarter of 1946, a recent New York Stock Exchange compilation showed. Automotive companies, however, registered only a slight 2 per cent increase. Of the 65 listed, 41 paid $50 million in the first quarter of 1947 as compared to 41 paying $49 million in the first quarter of 1946.

Labor

GM Penalizes Leaders Of Unauthorized Walkout

Although it did not achieve much publicity, a recent development in labor relations marks a significant change in the attitude of the UAW-CIO. Following the recent labor rally in Detroit during which workers left the job and required most automobile plants to close, General Motors Corp. fired several men who had called the workers off the job. Included were four local presidents and six committee chairmen. The UAW-CIO protested the action and in subsequent negotiations GM modified its position only to the point of reducing the discharges to layoffs ranging from two days to 2½ months. It is understood, however, that the union agreed that in the future such a violation of the contract would be cause for discharge. Another significant development is that the International Union accepted responsibility for the workers'

Electronics Do the Work



Installed at the head of the line of electronically controlled dynamometer test stands at Dodge Div., Chrysler Corp., this demonstration model has a visual test board which is equipped with lights that indicate changes in cycle. The sequence of operations is as follows: 1. Electric power on test stand; 2. Ignition timing is properly set; 3. Ignition current on stand; 4. Engine test control current now on stand; 5. Valve for throttle control now operating; 6. Oil circulating thru engine; 7. Water circulating thru engine; 8. Engine starting test cycle; 9. Engine being put under load; 10. Engine operating at half load; 11. Oil drain valve closed—crankcase filled to oper. level; 12. Engine now operating at full load; 13. Only when engine is rejected. *(Please turn to page 42 for further details.)*

action since it had asked them to attend the rally. As a result, it will reimburse the employes for an estimated $17,000 in wages lost during their layoff. GM was the only company to make an issue of the unauthorized work stoppage but it apparently has contributed greatly to reducing such actions in the future. It also is encouraging to note that the union at no time threatened any serious repercussions over the penalties, indicating a sense of responsibility, all too infrequent, in Detroit labor disputes.

Health & Welfare Clauses In Union Contracts

Interesting aspects of the current talk about health and welfare clauses are revealed in a recent study of 300 union contracts by the National Industrial Conference Board which shows that 15 per cent, or 45, contained employee health and welfare clauses. In 80 per cent of these, the entire cost was paid for by the employer.

Underwriting of the benefits by insurance companies was specified in 41 plans; administration of the fund by the union was specified in only two; the remaining two provided for joint management-labor control. In the 25 programs giving details, a comprehensive list of benefits were provided, including life insurance; accidental death and dismemberment benefits; nonoccupation accident and sickness benefits; and hospital and surgical benefits for employees.

Ford Personnel Policy Lowers Turnover Rate

The intensive effort being made by Ford Motor Co. to improve its employe relations appears to be making headway. According to company records, turnover of production labor at the Rouge Plant the first four months of this year has dropped 38.6 per cent under the average for 1946. The company's 1946 separation rate was 20 per cent below the rate of 4.4 per 100 employes for industry in the Detroit area.

Another departure at Ford is the elimination of the old mass production method of hiring at the Rouge employment office. The old long, impersonal "hiring counter" has been removed and applicants now are questioned by interviewers seated at desks insuring privacy. After an employe is hired, he is put through a new induction program in which groups of five to 100 are welcomed to the company and given an overall picture of operations and an outline of opportunities, privileges and responsibilities. Every effort is made to make the employe feel he is part of the company team.

Navy Two-Jet Fighter, Banshee, Flies 600 Mph

Designed and built by the McDonnell Aircraft Corp., the XF2D-1 Banshee, the Navy's newest and most powerful jet fighter, has been successfully test flown recently. Two Westinghouse 24C Yankee axial flow turbo jet engines 24 inches in diameter drive the Banshee at over 600 mph and at a climb rate of over 9000 fpm. Installed at the wing roots, the two jets are placed close to the centerline of the plane to minimize yaw when one engine is shut off.

Meeting all the exacting requirements of carrier operations, the Banshee has an unusually long range: five self-sealing internal tanks carry its large fuel load. Wings, flaps and wheels are electrically retractable. The Banshee's length is 39 ft overall, height 14 ft, take-off weight over 14,000 lb, and wing span 41 ft—18 ft when wings are folded.

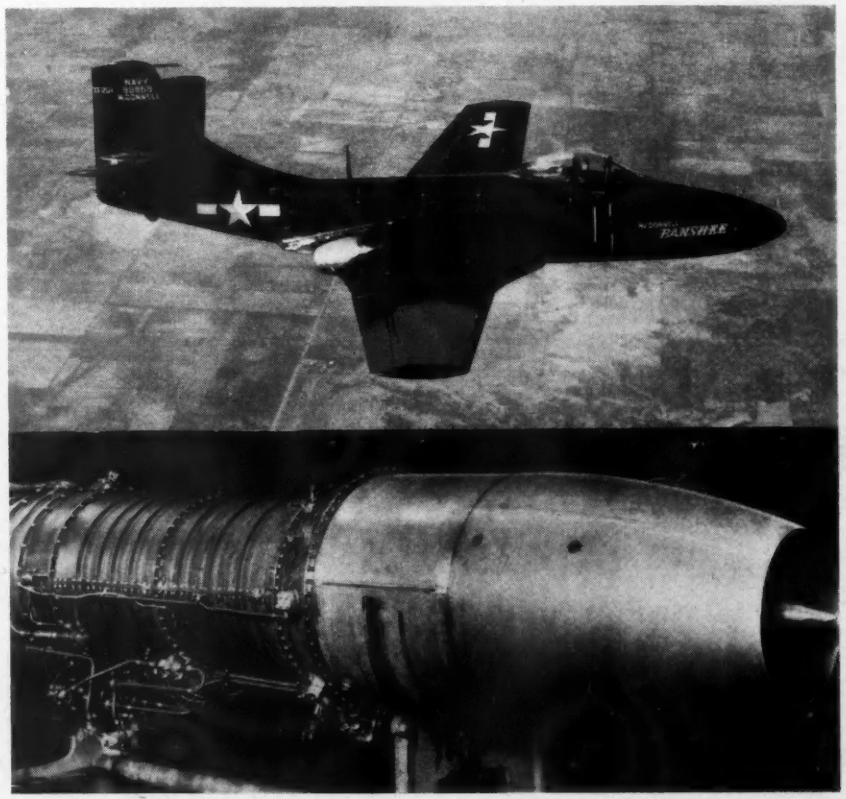
Metals

Copper

A multiple price basis still holds for the domestic copper market. Domestic production and a trickle of higher priced imported copper still leave copper producers with unfilled orders. Foreign copper is meeting with mixed acceptance, it is reported, as three or four of the very large brass mills are cutting down inventories, and, therefore, not taking copper; conversely, other brass mills are reported to be still seeking supplies.

(*Turn to page* 58, *please*)

The Navy's Banshee, Carrier Based Fighter



Successfully test flown recently, the McDonnell Banshee is the U. S. Navy's newest and reportedly the world's most powerful carrier based fighter plane. Two Westinghouse 24C Yankee jet engines, identical with the one illustrated here, power the Banshee to a top speed of over 600 mph and a rate of climb of 9000 fpm. The pair of slim axial-flow turbo-jets are 24 in. in diam and are mounted in the wing roots of the Banshee.

Design Highlights

By Robert T. Jackson

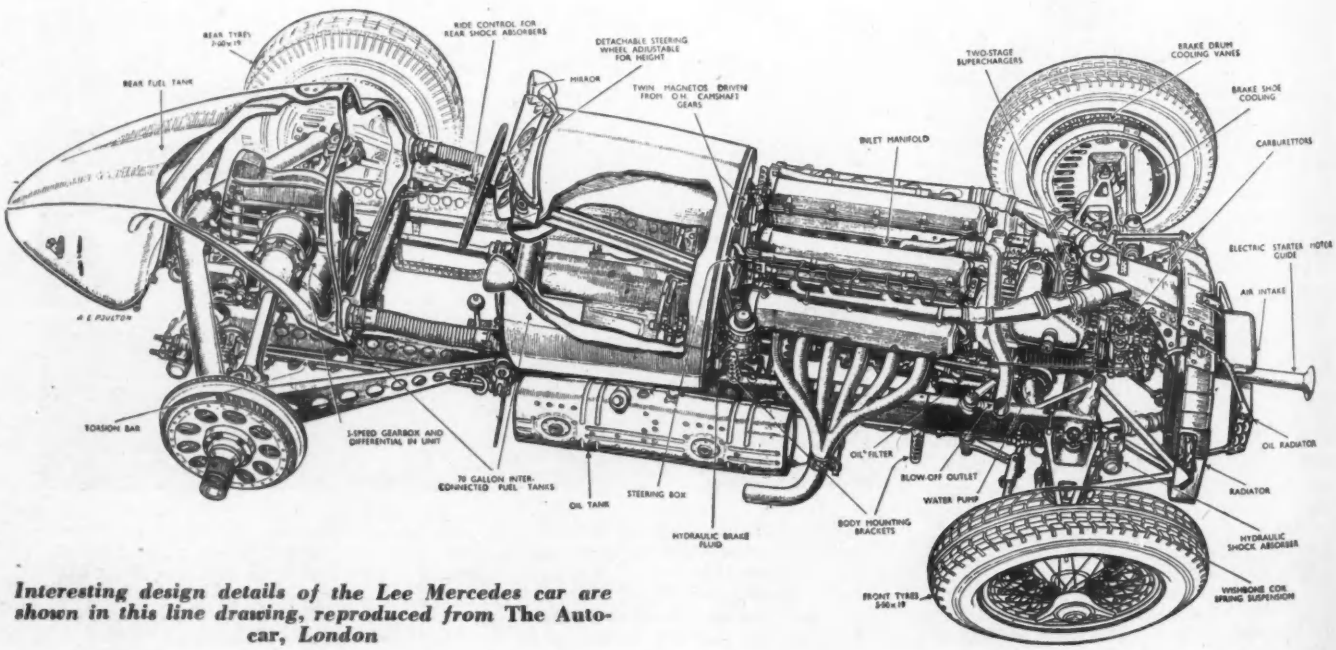
The Perfect Circle Co.

Lee is reported to have paid between $25,000 and $30,000 for this 480 hp Mercedes V-12 which was rushed by air from England several weeks ago. Mechanics worked around the clock to get it ready for the Indianapolis race

BECAUSE of a controversy over the amount of prize money, the 1947 Indianapolis Speedway entry list closed on April 15 with only 34 valid entries on the books. Basis of the controversy was a demand by ASPAR, an organization of drivers and car owners, that the Speedway increase prize money. However, on May 22, after several previous meetings between ASPAR and Speedway spokesmen ended in deadlocks, the divergent attitudes were reconciled. The original 35 entrants already had signed waivers permitting ASPAR entries. Under terms of the settlement ASPAR cars filled in gaps in the 33-car race lineup that resulted due to failure of some original entrants to qualify.

Mercedes V-12

The entrants were rather equally divided between fours and eights, with one six, one twelve, and one sixteen. The lone twelve-cylinder entry was a three-liter Mercedes-Benz which was purchased recently by Don Lee Inc. in England and brought to this



Interesting design details of the Lee Mercedes car are shown in this line drawing, reproduced from* The Autocar, *London

of New Cars in the Indianapolis Race

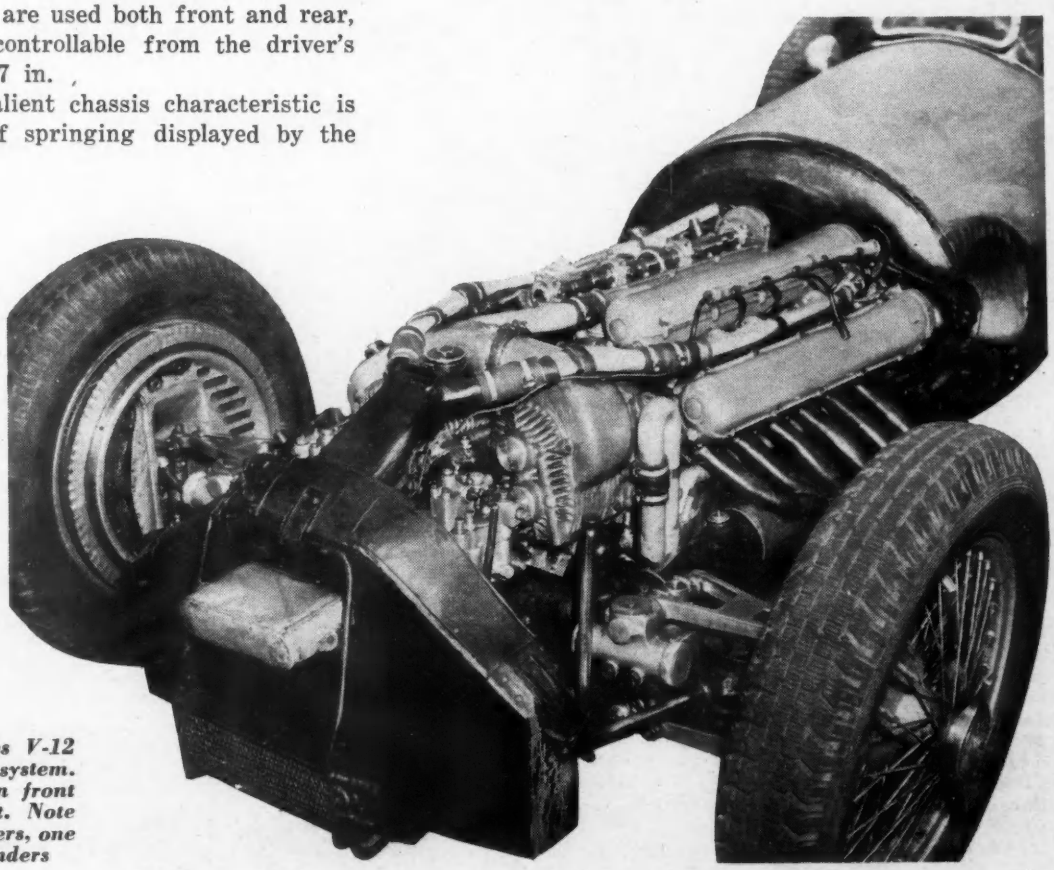
country several weeks ago. The engine is a V-12 with steel cylinders and of the conventional Mercedes construction. Believed to be the only one of its kind ever built, this car has set a world's class record of 248.3 mph. Its power output has been variously evaluated. When right, there is little doubt that this engine will give 480 hp at about 7600 rpm. It is supercharged by two Roots blowers. The engine is mounted off center, with the drive shaft geared to the rear axle off center to the left side. This enables the driver to sit lower in the car, and also keeps the car's center of gravity much lower. Root blowers, cam covers and crankcase are all magnesium castings, which contribute to the unusually low car weight of 1500 lb (with full fuel load of 70 gal).

The Mercedes chassis is of oval-shaped tubular construction, completely torch welded. Independent suspension with coil springs is used at front, and De Dion suspension with torsion bars at the rear. Hydraulic piston shock absorbers are used both front and rear, the latter pair being controllable from the driver's seat. Wheelbase is 107 in.

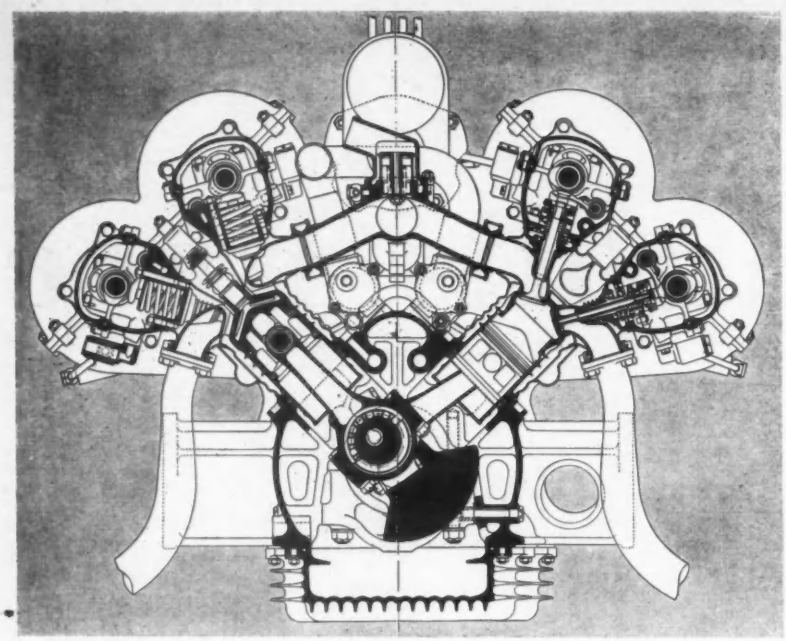
Perhaps the most salient chassis characteristic is the evident softness of springing displayed by the Mercedes design. By contrast with typical racing suspensions of former years, this soft springing explains much of Mercedes' now well-demonstrated road holding virtues.

Olson-Offy Design

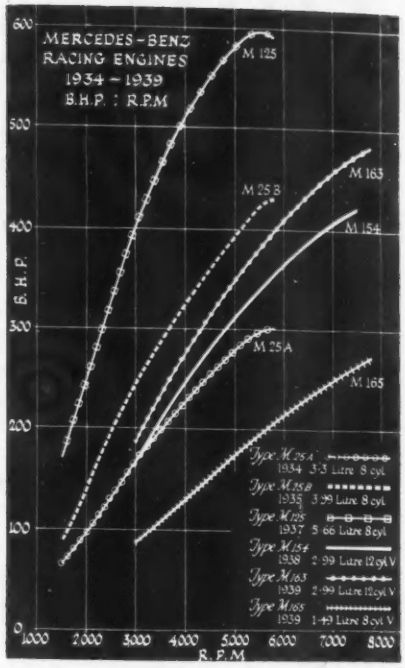
Considerable interest was shown in the suspension system of the Olson-Offy. The rear wheels in this car are individually sprung using four leaf springs on each side at right angles to the frame. The springs are attached to the hub at the outer end through a knuckle, giving a four-point suspension of each wheel. Two universal joints are used with each rear axle; one at the outer end and one next to the differential housing. Total weight of the car is 1600 lb, which is achieved through use of aluminum for the body,



Closeup of the Mercedes V-12 engine and its cooling system. Oil cooling radiator is in front of the water cooling unit. Note the two Roots superchargers, one for each bank of cylinders



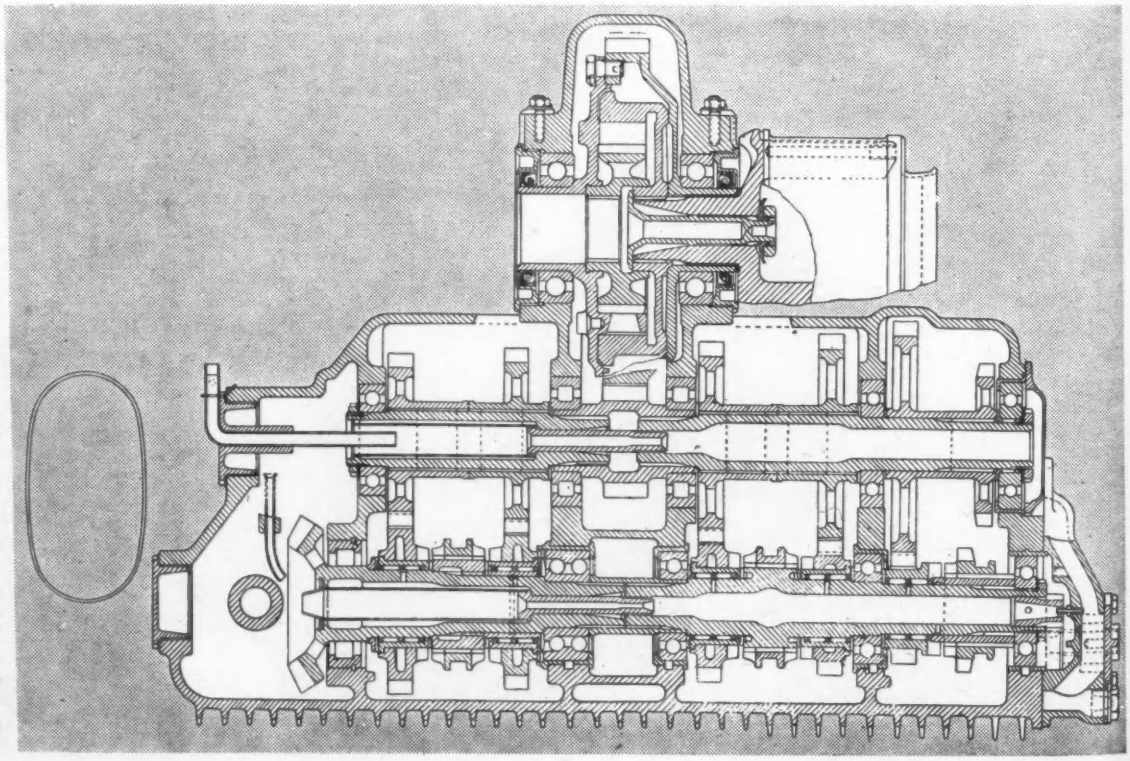
This drawing shows a transverse sectional view of the Mercedes-Benz M165 V-8 engine of 91 cu in. displacement. The M163 engine in the Lee car is similar in design. (Drawing reproduced from The Motor, *London)*



(Above) The chart gives horsepower curves of the principal Mercedes-Benz racing engines from 1934 to 1939. Type M163 is the V-12 engine in the Lee Mercedes car. (Curves reproduced by courtesy of The Motor, *London)*

bell housing, crankcase and differential housing. It has a special air scoop arrangement to direct the flow of air over the transmission and oil tank which is under the seat, and also to cool the oil pan of the engine. A special vent at the rear draws off the heated air.

The block and head are cast iron. The car has a 17 in. frame which is narrower than conventional and a 98½ in. wheel base which is six in. shorter than conventional. It also has a sealed cooling system which operates under nine psi which allows the water to reach a temperature of 239F before boiling. Tanks are of steel tern-plate, and all connections are also of steel. The oil tank is of 14 gal capacity. The engine, a four-cylinder Offenhauser of 270 cu in. displace-



Sectional view of the Mercedes M163 final drive. Power is transmitted through bevel gears, offset 8.25 in. laterally and 8.5 in. vertically, and thence through one of five pairs of constant mesh pinion to a pair of spur gears in the Z-F differential. (Drawing reproduced by courtesy of The Motor, *London)*

Specifications of Indianapolis Entrants

CAR No.	Car Name	Entrant And/Or	Driver	Engine Make	No. Cylinders	Bore	Stroke	Displacement	Supercharger	Ignition: Spark Plug	Ignition: Make	Ignition: Cable	Carburetors: Make	Carburetors: No. Used	Carburetors: Style	Piston Rings	Suspension: Front	Suspension: Rear	Shock Absorbers: Front	Shock Absorbers: Rear	Brakes	Starter	Drive	Fuel: Make	Fuel: Gallons	Oil: Make	Oil: Quarts	Weight
1	Bennett Bros. Spl.		Ted Horn	Mas	8	2.68	3.94	178	R-2	C	S	P	ME	2	H	PC	I	C	F	F-H	H	H	R	A	52	O	32	1900
44	Miller Spl. (Geo. Weaver)		Geo. Weaver	M	8	2.765	3.5	168	C	C	B	P	W	2	DD	PC	C	C	F	F	M		F	G	30	RPM	32	
6	Olson-Offy (Norm Olson)		Walt Ader	O	4	4.312	4.625	270	N	C	B	P	W	2	UD	PC	C	I	H	H	H	B	R	A	45	O	48	1800
5	T.H.E. Spl. (Ted Horn)		Tommy Hinnershitz	O	4	4.062	4.5	233	N	C	B	P	THE	2	H	B	C	C	H	H	H		R	A	56	O	30	
23	Not Named (Tommy Boggs)		Tommy Boggs	O	4	4.25	4.5	255	N	C	B	P	W	2	UD	PC	C	C	H	H	M	E	F	G	30		30	1880
58	Anderson Spl. (Les Anderson)		Les Anderson	O	4	4.312	4.625	270	N	C	B	P	W	2	DD	PC	C	C	H	H	H	D	R	G	45		40	1680
29	Miller Spl. (Robt. McManus)		Not Named	M	8	2.875	3.5	181	C	C	B	P	B		DD	PC	C	C	H	H	M	H	F	G	40	O	42	1900
53	Not Named (M. Fankhauser)		Milt Fankhauser	O	4	4.322	4.625	272	N	C	B	P	W	2	UD	PC	C	C	H	H	H	E	R	G	30		30	
7	Jim Hussey Spl. (H. C. Henning)		Jimmy Jackson	O	4	4.275	4.5	258	N	C	B	P	W	2	DD	PC	C	C	H	H	M	D	F	P	37	O	28	1960
43	Fed. Eng. Spl. (H. C. Henning)		Not Named	O	4	4.250	4.5	255	N	C	B	P	W	2	UD	PC	I	I	N	H	H	D	F	P	34	O	40	1980
62	Pauley Ford Spl. (J. E. Pauley)		Johnny Carpenter		V-8			269															R					
66	Maserati Spl. (Jim Brubaker)		Jim Brubaker		V-8			273								PC	I	I	F				R					1900
25	Federal Eng. Detroit Spl. (Richard Cott)		Russ Snowberger	Mas	8	2.68	3.94	178	R-2	C	S	P	ME	2	H	PC	I	C	F	H	H	H	R	A	52	O	32	2018
24	Automobile Shippers Spl. (Louis Rassey)		Shorty Caution	M	16	2.490	3.5	272	N	C	B	P	W	4	DD	PC	C	C	H	H	M	D	F	G	28		36	1900
31	Not Named (Louis Rassey)		Not Named	O	4	4.250	4.625	268	N	C	B	P	W	2	UD	PC	C	C	H	H	H	H	R	G	25		56	1750
67	Not Named (W. D. Chalmers)		Charles Crawford	D	8	2.813	2.75	138	C	C	B	P	W	1	UD	PC	C	C	GH	GH	H	H	R	G	35	RPM	32	1750
32	Kuehl-Osborne Spl. (David Osborne)		Duane Carter																									
35	E.R.A. (H. L. Brooke)		H. L. Brooke	ERA	6	2.48	3.15	91	Z		B		SU	2	DD		I	D	H	H	H		R	A	32			1450
65	Not Named (Jack Dixon)		Not Named	C	4	3.5	3.625	183	C	C	B	P	W	2	DD	PC	C	C	H	H	H	H	R	G	35		25	
18	Novi Governor Spl. (Winfield Eng. Co.)		Cliff Bergere	W	V-8	3.125	2.937	181	C	C	B	P	W	3	DD	PC	I	C	H	H	H	H	F	A	60		50	1919
22	Novi Governor Spl. (Winfield Eng. Co.)		Sam Hanks	W	V-8	3.125	2.937	181	C	C	B	P	W	3	DD	PC	I	C	H	H	H	H	F	A	60		50	1919
48	Mercedes (Don Lee, Inc.)		Not Named	Mer	12	2.625	2.755	183	R	B	B	P	P	2	H	PC	I	D	H	H	H	H	R	A	70	O	40	1500
47	Alfa-Romeo (Don Lee, Inc.)		Not Named	A-R	8	2.679	3.937	176	R-2	C	B	P	WE	2	UD	PC	C	C	HY	HY	H	H	R	A	60		36	2012
52	Palmer Spl. (Palmer Racing)		Not Named	O	4				N	C	B	P	W			PC	C	C	H	H	H	E	R	G	27.5		30	1955
41	Not Named (Ross Page)		Freddie Agabashian	O	4	3.812	4	183	R	C	B	P	M	2	DD		C	C	H	H	H	B	R	A	70		60	1890
16	Blue Crown Spark Plug Spl. (Lou Moore)		Not Named	O	4	4.312	4.625	274	N	BC	B	P	R	2	H	B	I	C	FH	H	H	D	F	P	50	O	40	1650
27	Blue Crown Spark Plug Spl. (Lou Moore)		Mauri Rose	O	4	4.312	4.625	274	N	BC	B	P	S*	2	H	B	I	C	FH	H	H	D	F	P	50	O	40	1650
49	Talbot (Z. Arkus-Duntov)		Z. Arkus-Duntov													PC							R					
69	Not Named (Houser-Allison)		Not Named	F	V-8	3.375	3.750	268	N	C		P	S	2	D	PC	C	D	F	F	M	E	R	G	20		29	2100
61	Not Named (Sam Greco)		Not Named																									
68	Not Named (Clay Ballinger)		Not Named																									
34	Not Named (Milt Marion)		Not Named	A-R	8	2.72	3.94	183	R-2	C	B	P	WE	2	UD	PC	I	I	HY	HY	H	H	R	A				1880
63	Not Named (Bill White)		Not Named	A-R	8	3.010	3.2	182	R-2	C	B	P	WE	2	UD	PC	C	C	FH	FH	H	H	R	A			30	1974
59	Canco Spl. (Granatelli)		Not Named	F	V-8	3.3	4.0	274	N	C	B	P	S	2		PC	I	I	F	F	H	E	R	G	25		21	1980

ABBREVIATIONS

Engine Make
Mas—Maserati
M—Miller
O—Offenhauser
S—Sparks
AR—Alfa-Romeo
C—Clemons
W—Winfield
Mer—Mercedes
F—Ford

Piston Rings
PC—Perfect Circle
B—Burd

Drive
F—Front
R—Rear

Supercharger
R—Rootes
C—Centrifugal
N—None
Z—Zoller

Spark Plugs
C—Champion
M—Maserati (?)
B—Bosch
BC—Blue Crown

Ignition
B—Bosch
S—Scintilla

Ignition Cable
P—Packard

Carburetors
B—Bendix
Me—Memini
M—Miller (?)
W—Winfield
S—Stromberg (?)
WE—Weber
Z—Zenith (?)
R—Riley
P—Pigget

Style
H—Horizontal
UD—Updraft
DD—Downdraft
*—Injection Type

Suspension
I—Independent
C—Conventional
R—Rubber Springing (?)
D—De Dion

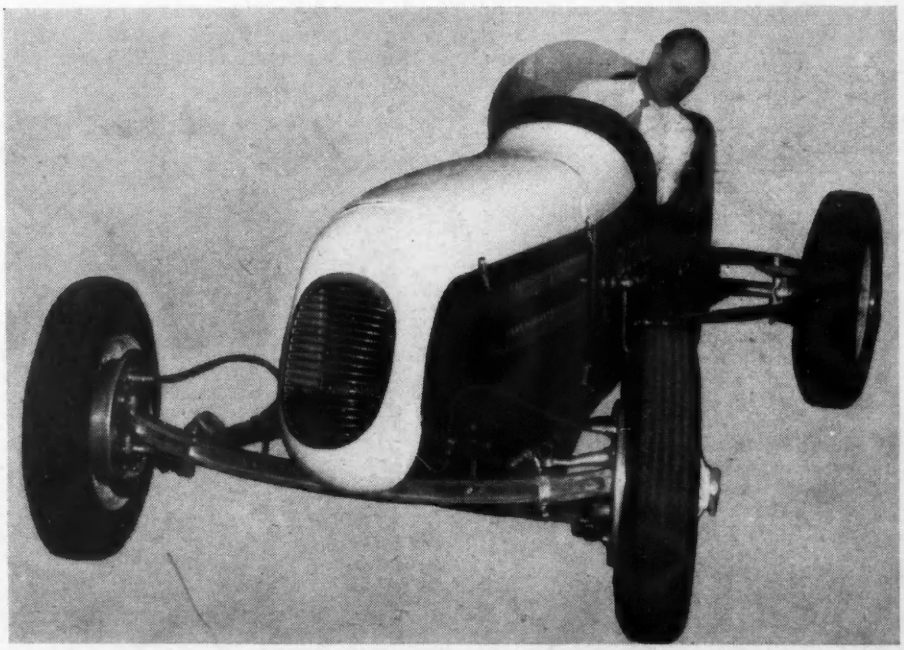
Brakes
H—Hydraulic
M—Mechanical

Shock Absorbers
Hy—Hydraulic
H—Houdaille
F—Friction Types
HF—Hartford
MA—Maserati
G—Gabriel
FH—Friction and Hydraulic

Starter
H—Handcrank
D—Delco
B—Bosch
E—Electric

Fuel
A—Alcohol Blend
G—Gasoline Blend
P—Petro-Gas

Oil
O—Oilzum
RPM—RPM



Olson-Offy racing car shown here is powered by a 300 hp four-cylinder Offenhauser engine. Rear wheels are independently sprung by two leaf springs to each one. Two universal joints are used with each axle

ment, is not supercharged and develops an estimated 300 hp. Transmission is of special design.

Also of interest was the Federal Engineering Detroit Special. This car is a Maserati eight-cylinder model. It has 178 cu in. displacement, 350 hp, two superchargers, torsion bar springing, individual front wheel steering through two steering arms (no tie rod), a wheel base of 107 in. and a weight of 1860 lb. Ignition is by Bosch magneto driven by the gear box at engine speed. A special air-cooled intake manifold is provided to drop the temperature of the fuel going through the manifold from the superchargers where it is heated to what was considered too high a temperature for maximum performance.

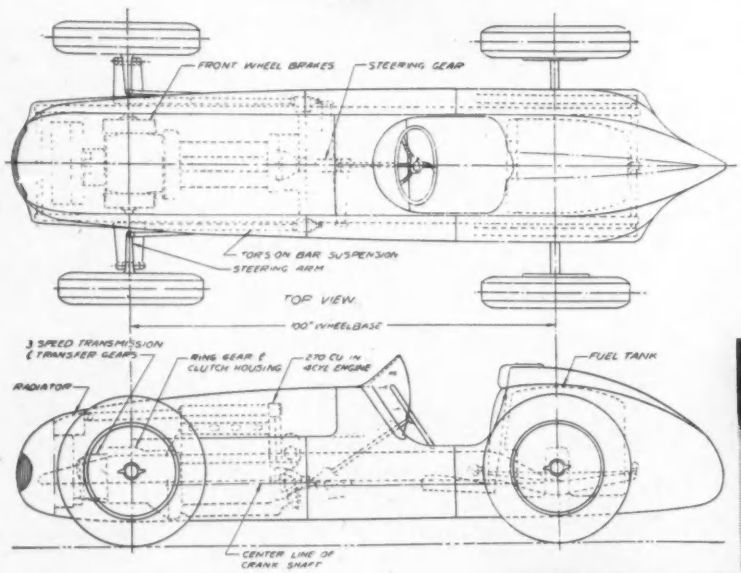
Blue Crown Specials

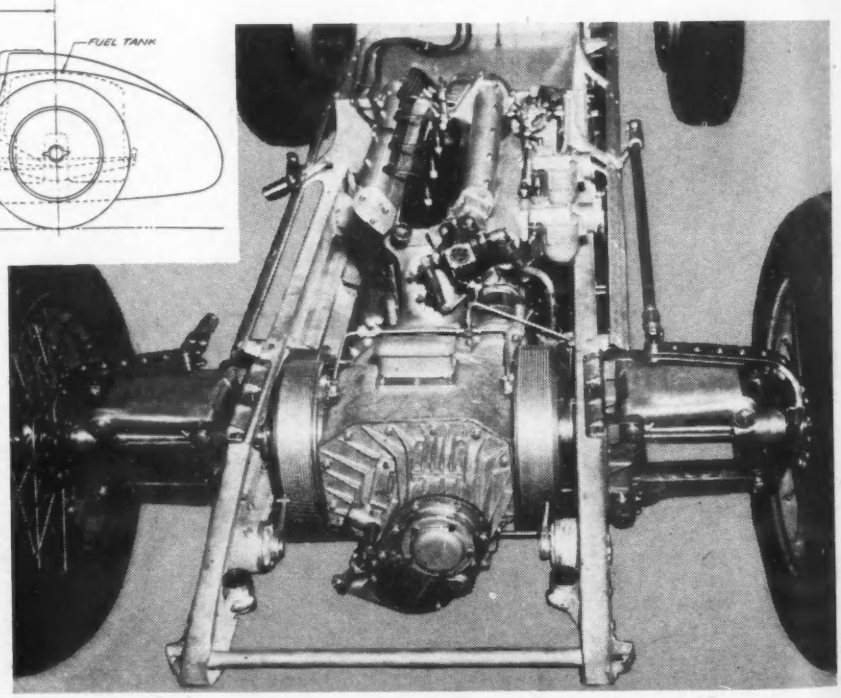
The two Blue Crown Spark Plug Specials, designed and built by Lou Moore, also are outstanding front drives. These cars are powered by Offenhauser 27° cu in. four-cylinder engines of 4 5/16 in. bore and 4⅝ in. stroke, and develop 27° hp at 6000 rpm at a compression ratio of 12 to 1. The two cars are virtually identical, one notable difference being that Stromberg injection carburetors were used on one and Rileys on the other. In both cases the dual installations are horizontal. Lubrication is of the full high-pressure, dry sump type, incorporating a separate oil supply tank and oil collar. Ignition is by magneto. Total weight of the car, not including fuel and oil, is approximately 1650 lb, and the top speed is estimated at 170 mph.

Front end construction of the Blue Crowns is similar to that of the Novis in some particulars. Independent suspension and torsion bar springing is used. Suspension members are aluminum alloy castings at top and fabricated-welded alloy sheet steel at bottom. Outboard universal joints are Rzeppa; the brakes are inboard, and steering gear is dual, with separate drag link to each front wheel. Rear suspension is by conventional semi-elliptic springs. The body lines are pleasingly simple and quite low. The matter of good accessibility apparently has received sufficient consideration.

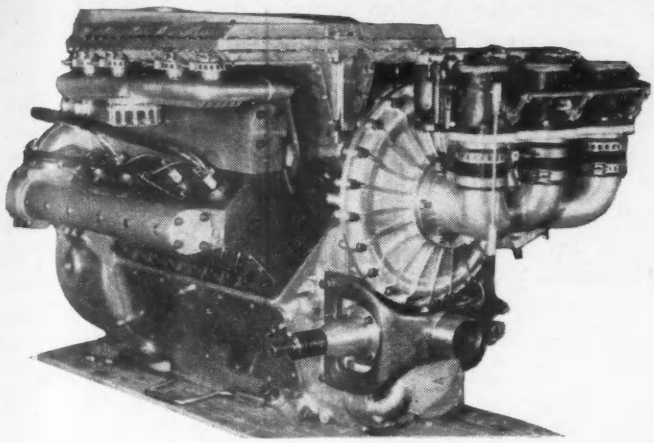
Novi 500 HP Car

Also deserving feature mention from

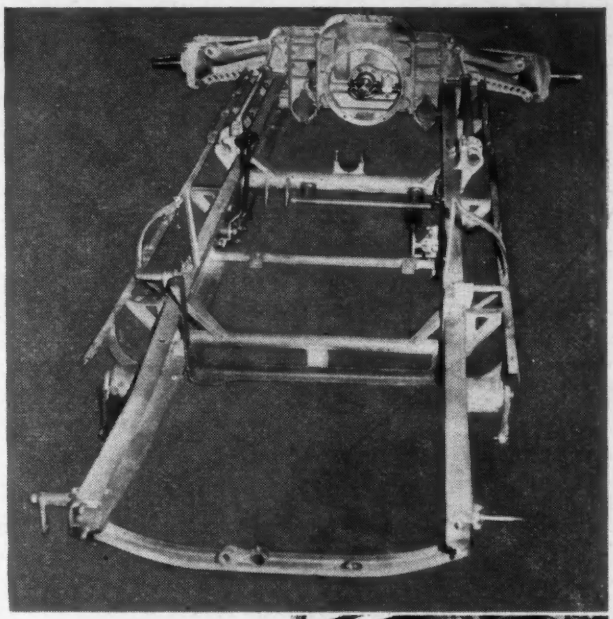




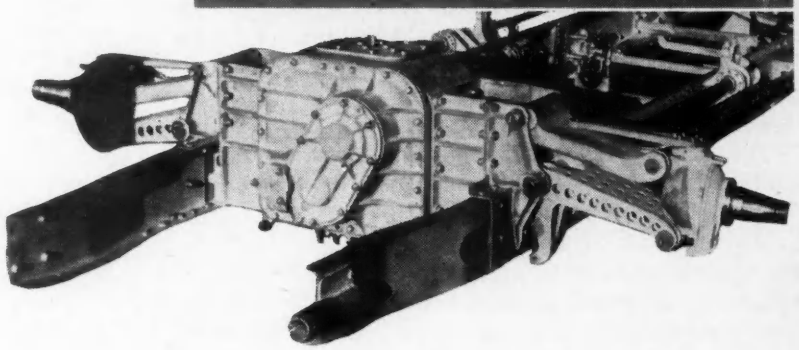
Four views of Lou Moore's newly-designed Blue Crown Spark Plug Special, a front drive car powered by an Offenhauser 270 hp engine and claimed to have a top speed of 170 mph. It has a dual steering system with a drag link to each front wheel. Mauri Rose is the driver in the upper photo



(Above) Rear view of Novi Governor 500 hp engine showing centrifugal supercharger and three carburetors

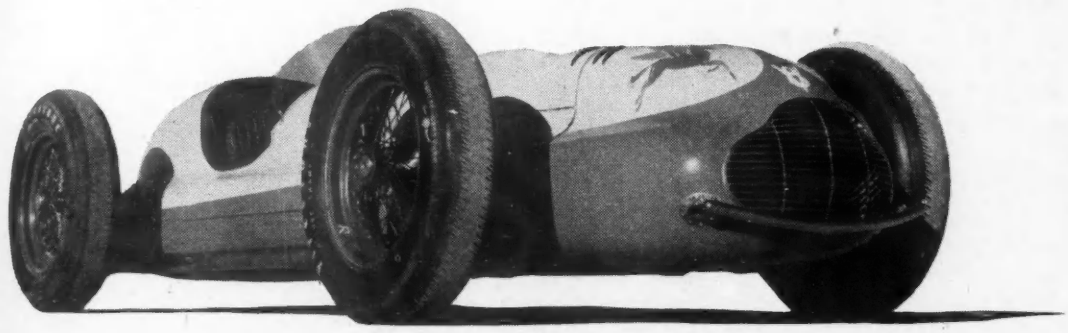


(Upper Right) Novi Governor frame as viewed from rear, showing rear of gear box

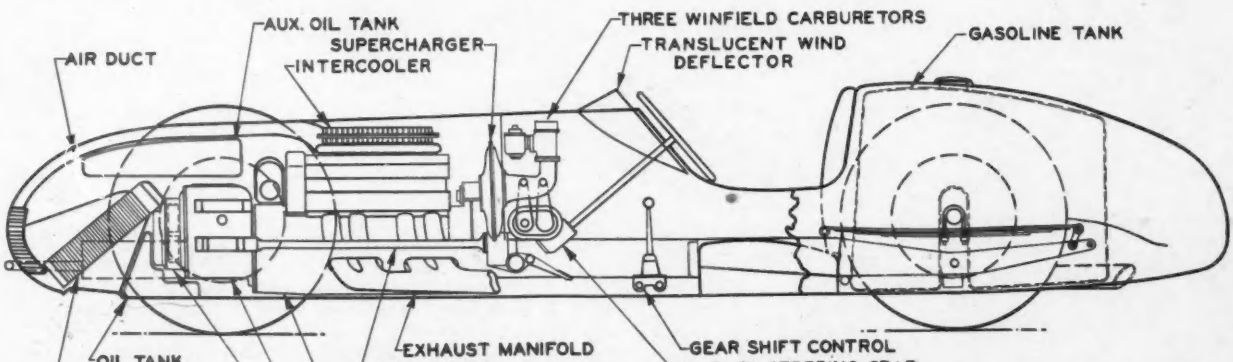


(Right) Front end of Novi Governor chassis, including frame, gear box, suspension arms and spindles

(Below) Latest Novi Governor Special as it looked in recent test at El Mirage Dry Lake



(Below) Line drawing of Novi Governor Special showing location of major units. Its wheelbase is 106 in. and overall length 176 in. Height is 36 in.



the design standpoint is the Novi Governor Special. During the 1946 trials Ralph Hepburn drove this type car at an average speed of 134.499 mph for the required 10 miles. This year the Winfield Engineering Co. entered two Novi Governors, both identical to the 1946 entrant except for a slightly higher manifold pressure and a changed compression ratio. Also, the camshafts are new with different cam contours; silver-lead connecting rod bearings are used; and the steering is improved by a change in arms, giving a different turning radius to the wheels. The inside wheel turns considerable more than the outside wheel. Design features of this car are shown in the accompanying illustrations.

British ERA Entry

The six-cylinder 90 cu in. car, entered by H. L. Brooke of Coventry, England, was designed and produced by the now defunct E.R.A. Co. It is powered with a six-cylinder supercharged engine of 2.48 by 3.15 in. bore and stroke, declared to develop 260 hp at 7506 rpm. Cylinders and crankcase are one casting, with two high camshafts operating the valves through short pushrods and rockers. Mounted at 90 deg in the aluminum head, the exhausts are sodium filled and of bigger diameter than the inlets. Bronze guides are used, with dual springs.

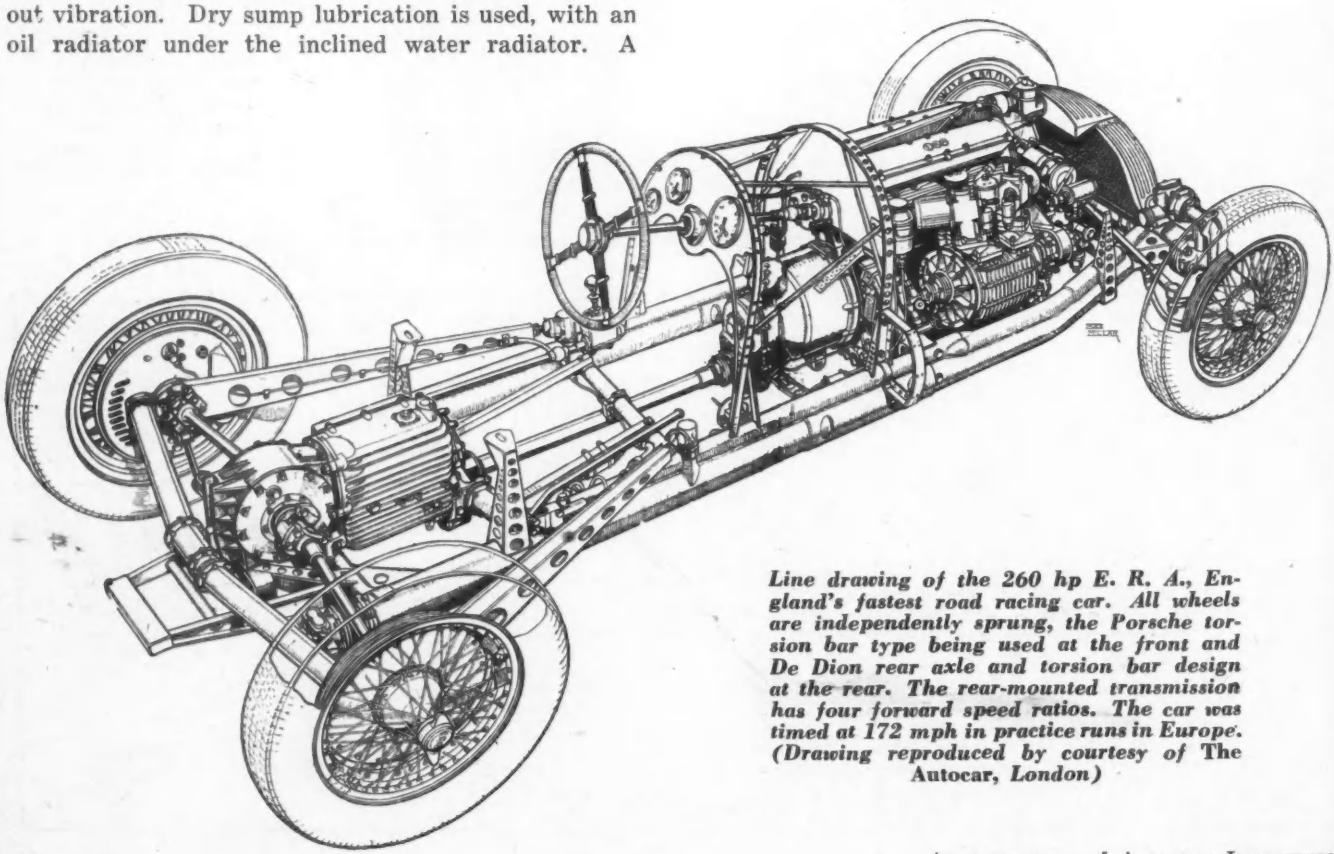
The crankshaft, machined from the solid billet, runs in three plain bearings, the center one being of very big diameter, with aluminum-tin alloy liners developed by Rolls Royce. Rods are I-section. A Zoller type supercharger, running at half engine speed, is mounted fore and aft on the right side, the drive being taken from the inlet camshaft. Two S. U. carbureters with a common float chamber are mounted above the blower, with heavy rubber inserts to damp out vibration. Dry sump lubrication is used, with an oil radiator under the inclined water radiator. A Bosch magneto with twin contact breakers is set across the front of the engine.

One of the features of the E.R.A. is a geared down drive shaft, with a four-speed transmission combined with the differential housing. While this entails some mechanical losses, it is believed that the reduced shaft speed and the improved head resistance more than compensate for this. The clutch is a multiple plate of E.R.A. design, laid out to keep diameter as low as possible. At the rear of the clutch housing a gear train gives the reduction for the open drive shaft. Heavily ribbed and bolted to the differential housing, the unit thus obtained is suspended, the differential being carried on a cross member of the frame, and the forward attachment being on a trunnion. Four synchro-mesh gears are used, together with a limited-slip German differential manufactured by the Z. F. Co. Final drive is taken to the road wheels by short open shafts with a universal at each end.

All four wheels are independently sprung, the De Dion type being used at the rear. The rear hub assemblies are connected by a tubular member positioned by a long vertical keyway at the rear of the axle casing, in which the members have a vertical movement. There are two radius arms going from the hub assemblies to a point on the frame members, with ball and socket attachment. The torsion bars providing the suspension are mounted inside the tubular frame members, the forward ends being anchored, while the rear end of each bar is linked by a short jointed arm to the rear wheel, the system including hydraulic dampers.

At the front, Porsche type independent suspension is used, with the torsion bars parallel and inside a

(*Turn to page* 56, *please*)



Line drawing of the 260 hp E. R. A., England's fastest road racing car. All wheels are independently sprung, the Porsche torsion bar type being used at the front and De Dion rear axle and torsion bar design at the rear. The rear-mounted transmission has four forward speed ratios. The car was timed at 172 mph in practice runs in Europe. (Drawing reproduced by courtesy of* The Autocar, *London)

Automotive Generators

Adaptable for Personal Aircraft

Delco-Remy Engineer Discusses Electrical Problems in Paper at SAE Personal Aircraft Meeting in May at Wichita. Abstracts of It and Other Papers Are Presented Here.

Adaptation of Automotive Electrical Equipment for Personal Aircraft

By J. B. Hiday
Engineering Department,
Delco-Remy Div.,
General Motors Corp.

The equipment requirements for an airplane are very similar to those of an automobile, and the price of such equipment is low enough to make it very attractive to the manufacturers who are trying to build an airplane for a popular market. The weights and adaptation of some of the standard electrical units have not in some instances been so attractive.

By using aluminum end bearings and by removing steel from the frame where it isn't needed for electrical purposes, it has been possible to reduce the weights of the units without seriously increasing costs. The same high production tools are used on laminations, commutators, brush rigging, pole pieces, frames, armature and field windings as are used on automotive production. The weight saving on the generator has been considerable, a 25-amp 12-v generator weighing 14 lb, and a 12-amp unit only 10 lb.

In order to take care of the moisture conditions and the possible long periods of idleness, the windings are especially impregnated and some of the internal parts are treated to prevent corrosion. This follows closely the practice used for marine equipment. This slight additional expense is believed to be justified.

Largest production so far has been on generators of 12-amp capacity, but some 25-amp units are being used and 35-amp units are available. The increased outputs are obtained by using longer frames. All of these frame lengths are standard for other purposes. The 12-amp generator is ample for the small airplane which is flown mostly in the daytime and doesn't have too much equipment. As the load is increased it becomes necessary to increase the generator capacity. The generator must be capable of furnishing the current for the running load and most of the intermittent load. With the small capacity batteries being used at the present time, a discharge of more than 15 or 20 amp will lower the voltage sufficiently to affect the operation of the radio and the motors used for flaps and landing gear.

If and when battery ignition is used on aircraft engines, the generator will have to be improved. The CAA has ruled that the generator must be capable of carrying the electrical requirements under all conditions of flight. This means that the generator must carry the load at low engine speeds. This is not a new problem since good low speed performance has been a requirement in passenger car, truck and bus applications for years. The overall system will be less expensive, lighter and more dependable than the present ignition systems.

Since the generator is driven from the engine, some means must be used to prevent damage to the armature or gear caused by torsional vibration. All gear-driven generators are using either a flexible coupling or a friction damper. The cheapest and most satisfactory drive is a "V" belt. Two engines on the market at this time are using belts and the results have been very satisfactory. After trying gears, chains and couplings of various types, belt-driven generators have become practically universal on automobiles. This arrangement is cheaper, more quiet, and has a greater ratio flexibility. Admittedly, the mounting of a belt-driven generator presents some problems, but with new designs it is not impossible.

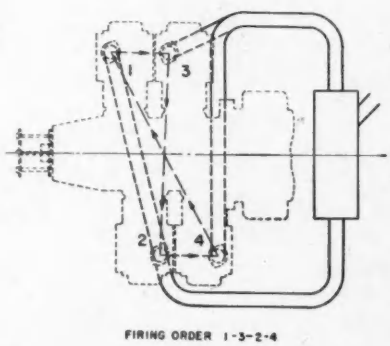


Fig. 1—Cross-over exhaust system for four-cylinder engine

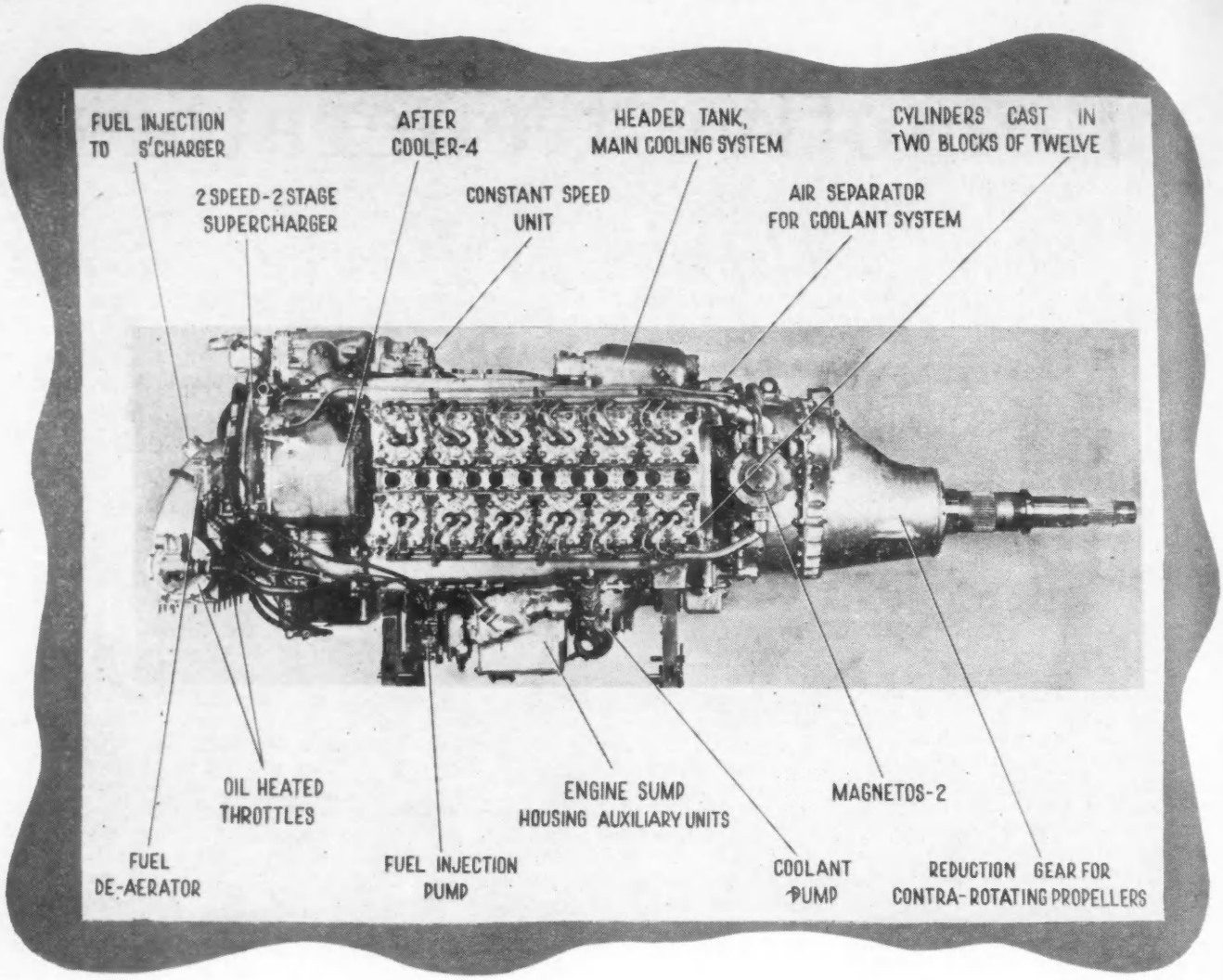
Engine Exhaust System for Light Aircraft

By D. S. King
Assistant Chief Engineer,
Lycoming Div.,
The Aviation Corp.

Tests with jet exhausts and manifolding have indicated that exhaust manifolding losses are minimized or eliminated when the exhaust pipe arrangement is such that it does not permit a single pipe to carry exhaust gases from two or more cylinders with overlapping exhaust strokes. Apparently a pressure wave is carried through the exhaust system which adversely affects the output of either or both cylinders when these exhaust impulses overlap.

Toward this end, an experimental exhaust system arrangement was designed to give 360 deg spacing of the exhaust charges carried by any single pipe or manifold. This arrangement is illustrated diagrammatically in Fig. 1. After experiments with pipe sizes it was possible to produce an exhaust system with the same muffler used in original installation that gave power output comparable to or better than that previously obtained with open exhaust stacks. This is shown in Fig. 2. Advantages of "cross-over" manifold design are admittedly greater at the higher engine speeds and fuel flows shown, but for the range tested this

(*Turn to page* 90, *please*)



Starboard side of the Rolls Royce Eagle powerplant

THE most powerful piston-type engine in England, the Rolls Royce Eagle of 3500 hp, was chosen to power a high-performance Naval fighter still on the secret list, designed and built by the Westland Aircraft Co., of Yeovil, England. First flight trials took place last year and both engine and aircraft fulfilled expectations. This aircraft is now undergoing flight development and it is expected that the Rolls Royce-Westland combination will establish new performance standards for single-engined, piston-powered, fighter aircraft.

By W. F. Bradley
Special European Correspondent
of
AUTOMOTIVE and AVIATION INDUSTRIES

The Eagle is a horizontal H 24-cylinder engine, the cylinders being in four banks of six, with a bore and stroke of 5.4 in. by 5.125 in., giving it a piston displacement of 2810 cu in. Its features are sleeve valves, liquid cooling, a two-speed two-stage centrifugal intercooled and after-cooled supercharger, direct fuel injection, and reduction gear for Contra-rotating propellers. While this is the first sleeve valve engine to be produced by Rolls Royce, an experimental 24-cylinder X-type sleeve valve engine has previously been built, but the project was dropped due to the war.

Among the considerations which have led to the adoption of sleeve valves is that of overall area. The cylinders being horizontal, width has been held to 43.5 in., while the heads and plugs have been made particularly accessible. Overall length is approximately 135.5 in. and height 50 in. Having a frontal area of only 10.6 sq ft, the ratio of power to frontal area is 330.2 hp per sq ft, which is 10 hp less than the much smaller Merlin engine. The bmep is 282 psi, which is higher than any previously published figure for a sleeve valve engine, and is an indication of what can be done by efficient supercharging and liquid cooling.

The cylinders are cast in two blocks of 12 to assist rigidity, and the blocks and crankcase halves are held in compression by 24 high tensile steel tie rods, four to each cylinder, which pass through the engine and are nutted on the external face of the cylinder head.

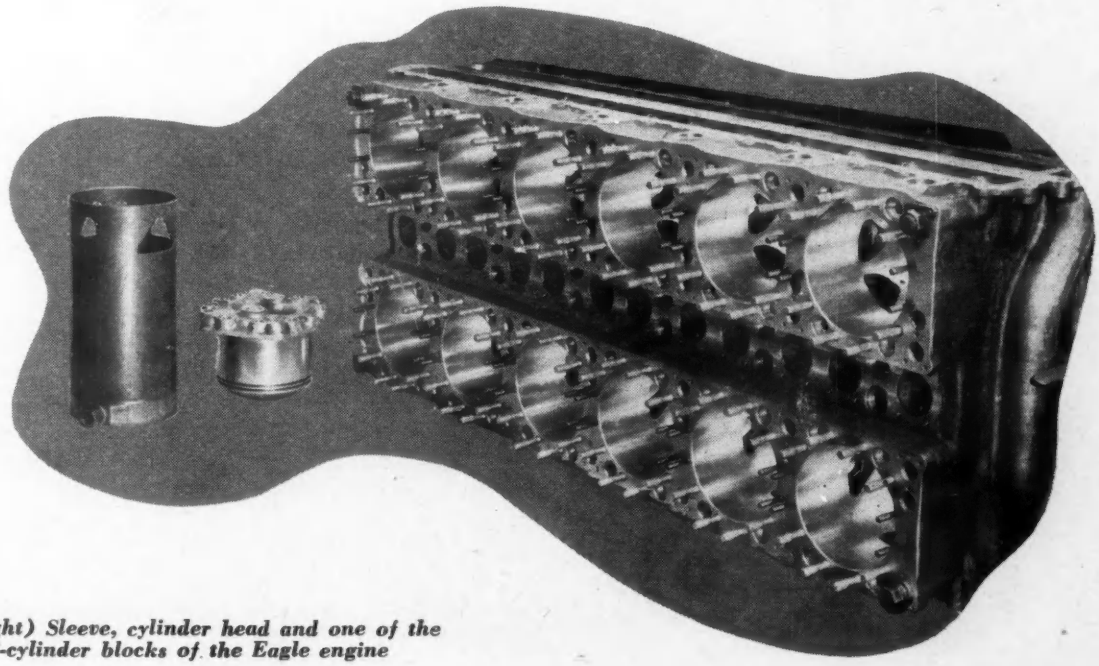
Major Design Features of the

Rolls Royce 3500 Hp. Engine

The crankcase is in two parts and of extremely robust construction with individual panels, reinforced by ribbing, for the seven main bearings of the two crankshafts. The main shafts are of the four mass-balance type, with a torsional damper on the rear balance weight of each. The oppositely rotating crankshafts are arranged in conjunction with paired cylinder firing to provide substantial balancing of all major forces. Paired cylinder firing also reduces the torsional vibration the propeller has to withstand.

There are three inlet and two exhaust ports per cylinder. A longitudinal drive shaft, fitted on each cylinder block and operating the sleeves in the upper and lower banks of cylinders, has integral worm gears which engage with worm wheels mounted on six pedestal bearings. The shafts are driven by spur gearing from the rear end of the upper crankshaft, and they are hollow to convey main pressure oil to the worm gear bearings.

The two-stage centrifugal, intercooled supercharger has impellers of 19.5 in. diameter for the first stage and 17 in. for the second stage, with M.S. gear ratio of 3 to 1 and F.S. ratio of 3.67 to 1. There is a spring cushioned drive from the rear end of the upper crankshaft through hydraulically operated centrifugal clutches. After coolers, which are entirely separate from the main coolant system, are placed between the four supercharger outlets and the induction pipes to cool the mixture after compression. Intercooling of the mixture is provided by vane annular passages in the supercharger casing between the first and second stage impellers. The air intake is updraft with the discharge nozzle of the fuel system injecting gasoline directly into the airstream at the supercharger eye. The gasoline pump, manufactured by the S.U. Carburetor Co., is small and light and contains five plunger pumps operated by a swash plate. The stroke and capacity are altered by variations in the angle of the swash plate, which assumes a mean position after compensating for all the variables determining fuel demand. As the pump is of the positive displacement type, elimination of air from the system is covered by a de-aerator interposed between the delivery



(Left to right) Sleeve, cylinder head and one of the two 12-cylinder blocks of the Eagle engine

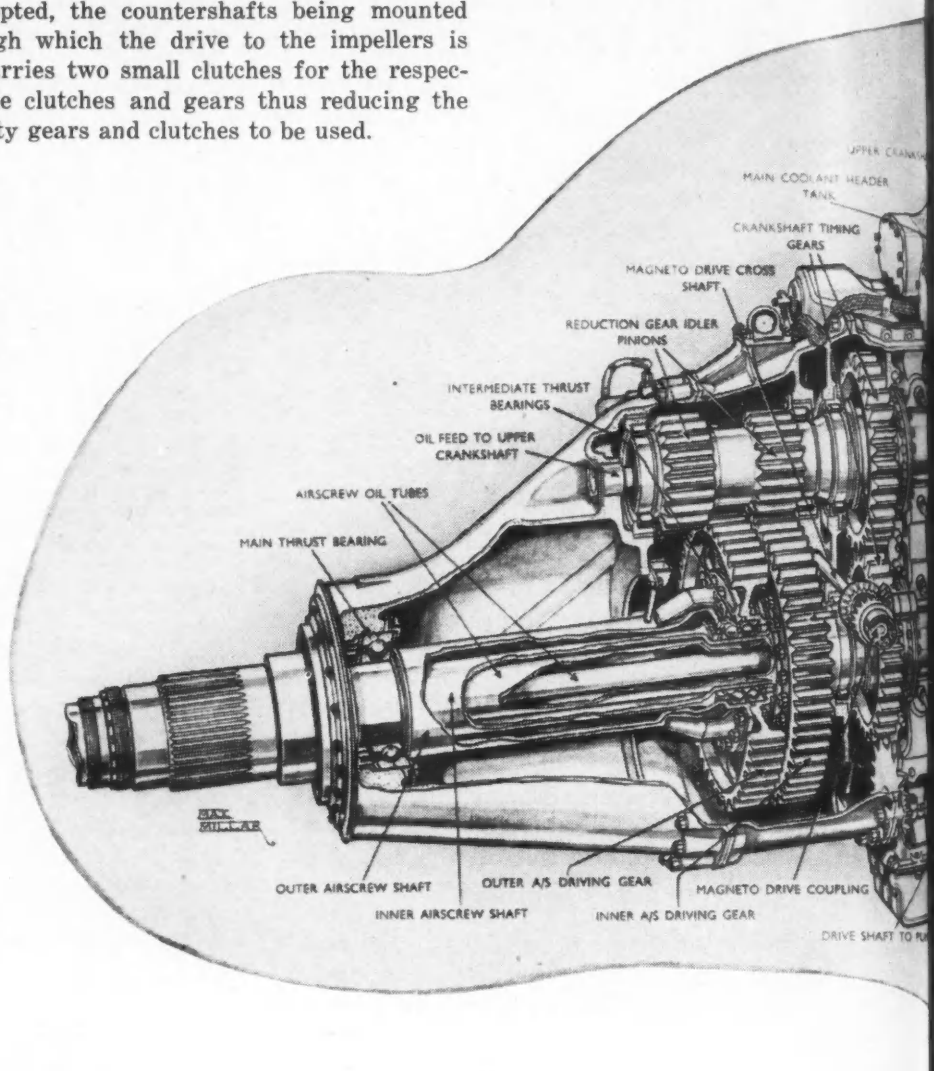
side of the pump in the aircraft tanks and the suction side of the fuel pump.

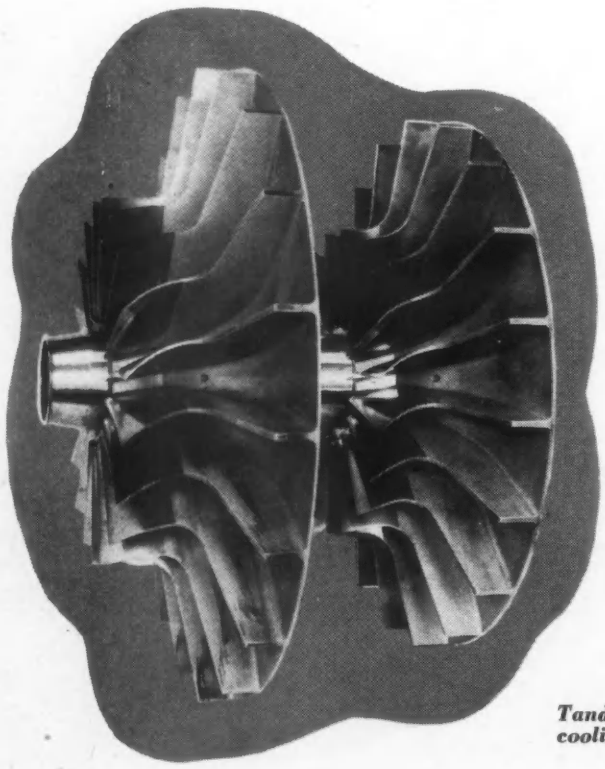
Over 1000 hp being transmitted by the clutches and supercharger drive, considerable design work had to be done to provide gears and clutches of sufficient capacity and of reasonable size to transmit this power. A two countershaft scheme has been adopted, the countershafts being mounted at each side of idler gears, through which the drive to the impellers is transmitted. Each countershaft carries two small clutches for the respective supercharger ratios, the double clutches and gears thus reducing the torque load and enabling low capacity gears and clutches to be used.

Engagement of the friction clutches for the two ratios of supercharge is by centrifugal weights placed between the clutches. The change in ratio is effected by a hydraulic ram housed in the wheelcase and linked by a forked rod to a sliding cylinder in each supercharger drive layshaft. The supply of oil to the ram is controlled by a piston valve actuated by a solenoid. The change in ratio can be made either by manual operation of an electrical switch or automatically by an aneroid which closes the electrical circuit at the correct altitude. Despite the capacity to deal with the enormous air consumption of the engine, the supercharger and coolers have been kept down in dimensions so as not to extend beyond the width of the cylinder blocks.

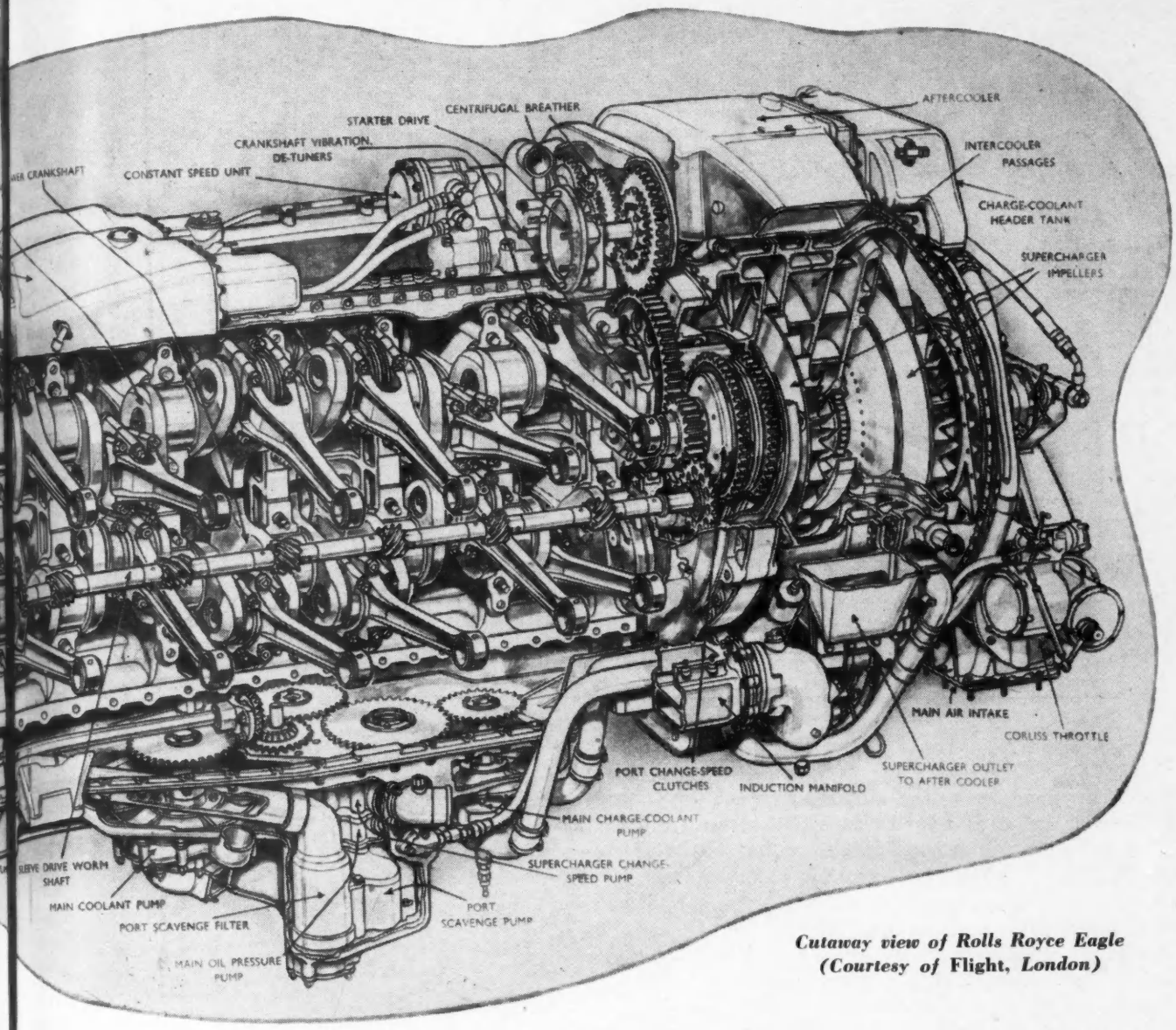
The cooling system is of the shunt type, under which pressure loss on the inlet side of the coolant pump, which would upset the mass circulation, is eliminated. The system is a closed circuit, the coolant flowing from the pump through the cylinder blocks to swirl type outlets at the top of the blocks and then to the radiator and back again to the pump. The swirl outlets separate the vapor from the coolant and pass it to a header tank mounted on the top of the engine. This tank acts as a reservoir for the coolant and is connected to a venturi at the pump inlet. Should there be any drop in pressure at the pump, due to cavitation, it is immediately restored by a flow of coolant from the header tank to the venturi.

Engine control is by means of a semi-circular plate-type throttle in the air intake, giving an entirely unrestricted flow into the supercharger. The throttle





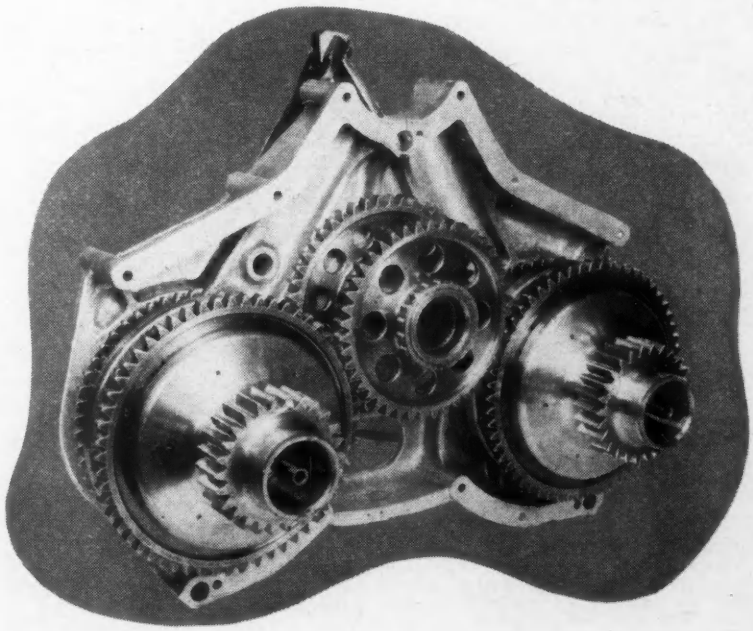
Tandem impellers supercharge the Eagle. Intercooling is provided through annular passage in the supercharger housing



Cutaway view of Rolls Royce Eagle (Courtesy of* Flight, *London)

is designed to have an opening tendency on acceleration, due to an out-of-balance weight, and a closing tendency on deceleration. By reason of its shape, the throttle is also free of all aero-dynamic loads, as these act normal to the surface and are therefore dissipated as bearing loads. The throttle is gear driven from the boost control and the ratio of throttle movement to pilot's lever movement is to 1 to 1 over the whole range. This assures maximum sensitivity to pilot's control. A variable datum boost control, interconnected with the supercharger throttle

(*Turn to page* 56, *please*)



Arrangement of the supercharger drive with a double-clutched countershaft at each side

A New Approach to the

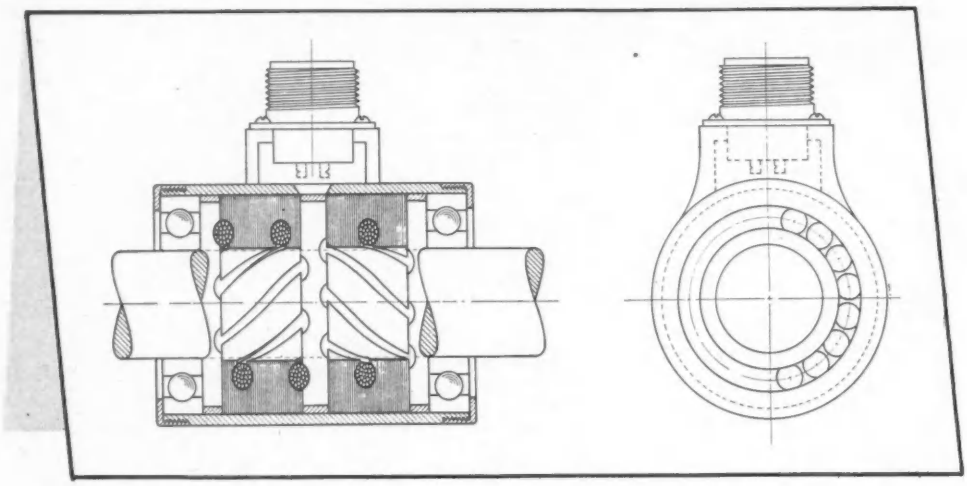


Fig. 1 — Schematic diagram of pickup.

In a new approach to the torquemeter problem, the Armour Research Foundation of Illinois Institute of Technology is developing a magnetostrictive device which will measure both average and instantaneous values of crankshaft torque. This new torquemeter, utilizing a principle devised by C. M. Rifenbergb, measures torque by detecting magnetic and electrical changes due to torsional stress in the material comprising the shaft surface. It makes use of a small compact pickup which is installed over the end of the shaft, an alternating-current bridge unit, and an oscilloscope or other indicating instrument.

Two helical coils are contained in the pickup, and are located coaxially with the shaft. An electric current, passed through these coils, sets up flux linkages in the outer layers of the shaft. A change in stress causes a variation in the flux and results in an impedance change. This effect is translated by an electric circuit means to provide a torque-proportional output current for actuation of an electric meter or oscillograph calibrated in terms of torsional stress or of any desired related quantity.

The only modification of the rotating shaft required by the torquemeter is the addition of a thin coating or metal film overlay to a short axial length of the standard shaft's surface. The two stationary pickup coils, which react differentially to the resolved tension and compression components of torsional stress, are electrically identical and therefore balance out responses due to temperature and other undesired influences.

The above is an abstract of the article, "A Unique Torquemeter," by K. W. Miller, which appeared in *The Frontier*, published by Armour Research Foundation of Illinois Institute of Technology.

The Pickup

The pickup, as shown in Fig. 1, introduces a 10 kc alternating magnetic flux in the outer layers of the shaft. The two coils are wound on laminated iron cores with six helical air gaps having a 45 degree pitch angle. The gaps in one core spiral clockwise while those in the other core spiral counterclockwise. In this manner, the flux from one core parallels the maximum tension stresses, while the flux from the other coil parallels the maximum compression stresses. The application of torsion, therefore, causes a differential change in the impedance of the two coils. The coils are placed in a housing which is positioned coaxially to the shaft by bearings.

The Electrical Circuit

The coils of the pickup constitute two arms of an alternating-current bridge. The remaining two arms of the bridge are contained in the electronic power source and detection unit. This electronic circuit unit contains all the necessary components for supplying the 10 kc energy and metering the bridge unbalance voltage. An oscillator of the resistance-capacity type supplies the 10 kc signal to a balanced power amplifier. The output of the amplifier is applied across the generator terminals of the bridge. A monitoring voltmeter enables this bridge voltage to be set and held to a desired value. The bridge unbal-

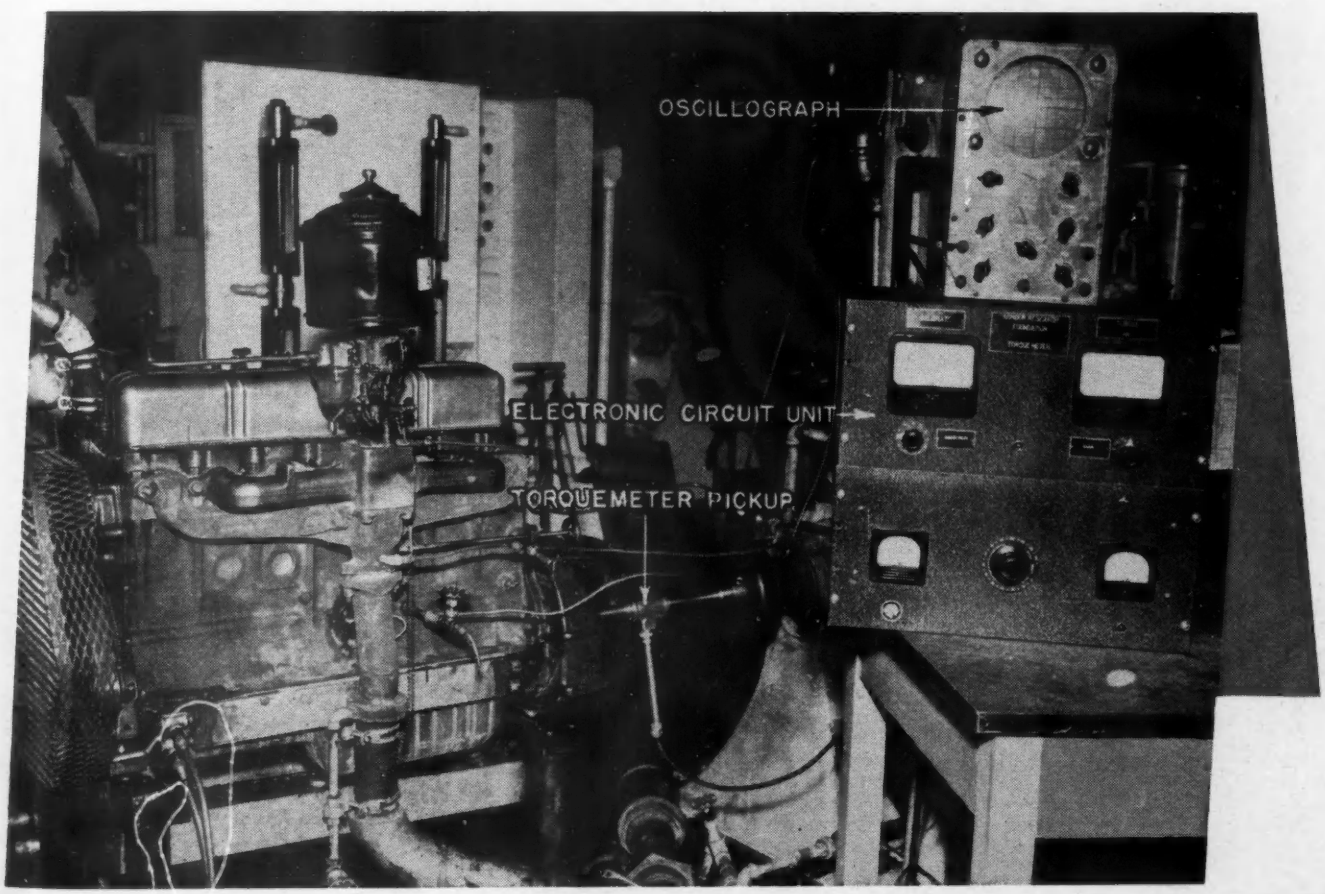
Torquemeter Problem

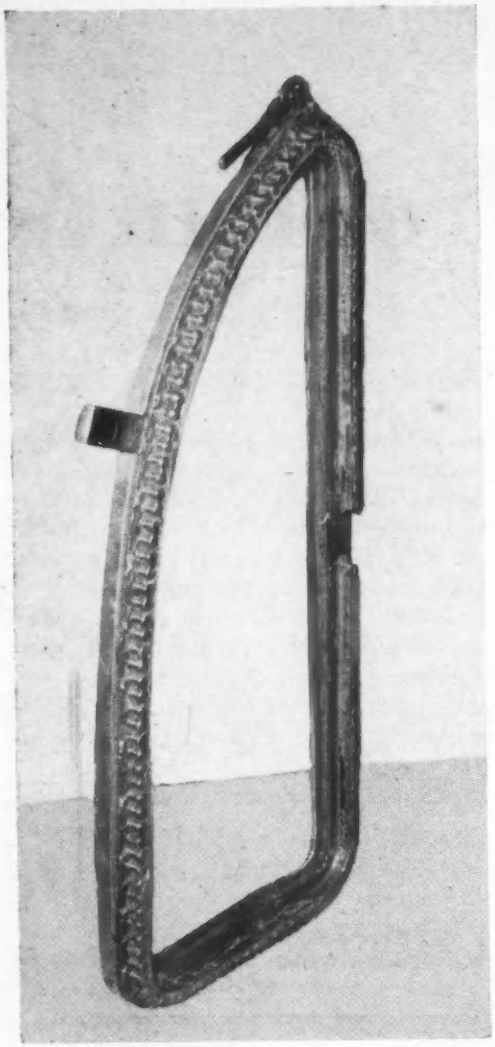
By K. W. Miller,
Chairman, Electrical Engineering Division
Armour Research Foundation of Illinois
Institute of Technology

ance voltage is applied to the input terminals of a frequency selective vacuum tube voltmeter which in turn supplies a meter movement and oscilloscope input channel. The average or static torque is then indicated by the meter movement which may be calibrated in units of torque or torsional stress. The oscilloscope channel supplies either a rectified modulation envelope or the unrectified modulation envelope indicating instantaneous torque on an oscilloscope for photographic or visual record. Operation of the circuit consists of setting the range switch to the desired torque sensitivity and setting the bridge supply voltage at a predetermined calibration value. The output of the instrument is of sufficient magnitude to operate standard recording instruments.

The torquemeter has been tested under actual running conditions on two engines. One engine was a single cylinder four-stroke Diesel developing 20 hp at 1000 rpm. The instrument gave both average and instantaneous torque indication satisfactorily for a period of continued engine operation. The torquemeter has also been installed on the drive shaft of a standard six-cylinder automobile engine delivering 30 hp at 3000 rpm as shown in Fig. 2. Oscillograms were obtained of instantaneous or dynamic engine characteristic torque pulsations under normal and abnormal conditions. The instrument proved to be very insensitive to mechanical vibration and electrical noise pickup.

Fig. 2 — Torquemeter installed on standard six-cylinder automobile engine.





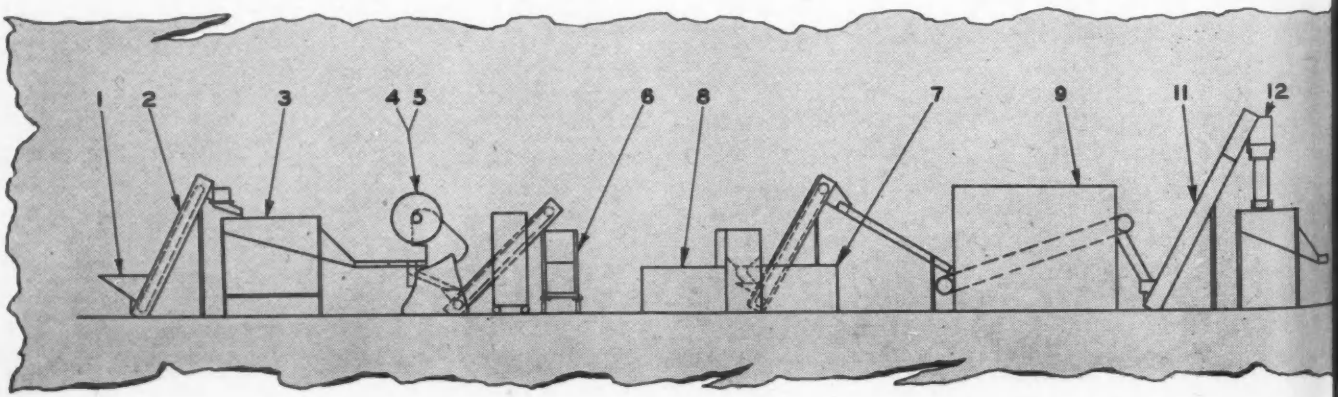
Unique

Facilitates

This close-up view shows details of the fixture used for polishing garnish moldings. The sprocket chain is part of the fixture and makes contact with a sprocket extending from the polishing machine table. The fixture is actuated by the sprocket and follows the contour of the work.

UNIQUE fabrication and polishing machinery, and material handling devices, combined with a plant layout emphasizing straight line manufacturing departments for each type of product, serve to provide the Fisher Body—Ternstedt Div., General Motors Corp., with an efficient means of producing body hardware and metal trim at its Detroit plant. Most parts such as reveal molding, garnish molding, and panels are produced from strip stock which is rolled into sections in form-rolling mills fitted with an automatic attachment for cutting to length. Window reveals are made either from stainless steel or brass strip chromium plated. In the case of stainless steel, the forming mills also are fitted with an automatic attachment for polishing the molding as it comes out of the mill. The next stage is that of bending sections to shape ranging from a CV frame, or half windshield, to the rear window reveal, a rectangular formation with compound curvature, using power-driven bending machines of different types.

Electroplating is another major activity since brass parts are chromium plated; the same being true of all zinc-alloy die-cast parts produced in the die-casting plant. These departments abound in automatic devices for buffing and polishing work of complex curvature. Latest development is the use of relatively small diameter rotary table machines with work presented to a series of power driven wheels. While moving under the wheels the work is suitably turned or revolved on its fixture so as to present every section of the part to the buffing or polishing wheels. For buffing long strips with curvature in one or more planes, special machines having wheels mounted on a horizontal stroking mechanism are used with a cam-controlled vertical action designed to follow the contour of a given part.



By Joseph Geschelin

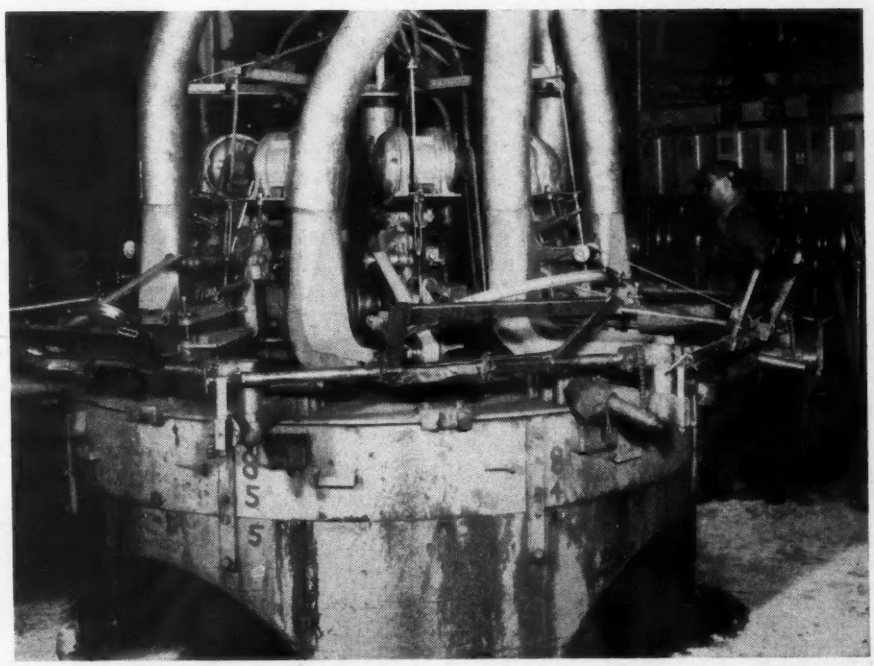
Machinery

Production of Body Hardware

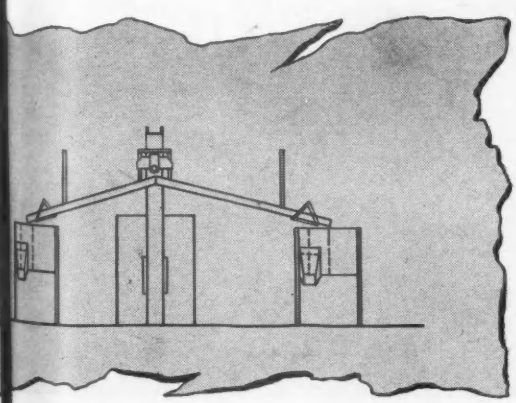
Interesting example of polishing intricately bent parts, such as window reveals, is a machine having a single buffing or polishing wheel overhead and a single small gear projecting from the table. Work is mounted in a rigid steel fixture of the same form as the work and having a sprocket chain attached to its lower edge. This is meshed with the sprocket which moves the frame around its entire periphery.

Garnish molding, instrument panels, and other moldings for certain makes of cars are finished in color with various grained effects simulating fine woods. Most garnish molding and strips are grained automatically in equipment designed for the purpose, the basic mechanism consisting of an etched steel cylinder from which the imression is transferred to a contacting gelatine or rubber roller, the latter transferring the pattern onto the painted metal strip. Smaller parts which require press operations use blanks which are grained in the flat, using enamels and lacquer coatings possessing sufficient flexibility and adhesion to conform to the deformation in press dies without fracture. With instrument panels, in most cases it is necessary to apply adherent grained pattern transfers directly to the panel.

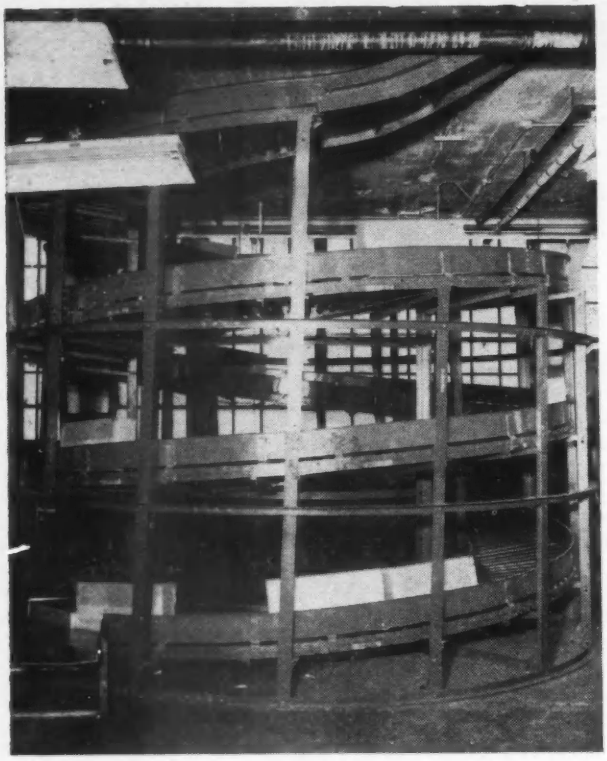
Wherever possible, enamel dip or the spraying of ground coats and lacquer is done automatically. In the case of sprayed parts, work travels on racks through spray booths where it is sprayed automatically. The racks move past spray guns which finish one side, then the racks are automatically rotated 180



Another rotary polisher is this machine (above) for smoothing the welded joint in garnish molding. The moldings are mounted in a fixture which is arranged to rotate the work in order to present the entire length of the weld to the wheel.



Drawing (at left) of conveyor line in die-casting division at Ternstedt, showing elevation and end view.



Shown in this photo is the spiral gravity roller conveyor for transporting packaged parts from the second and third floor assembly lines to the shipping dock on the first floor.

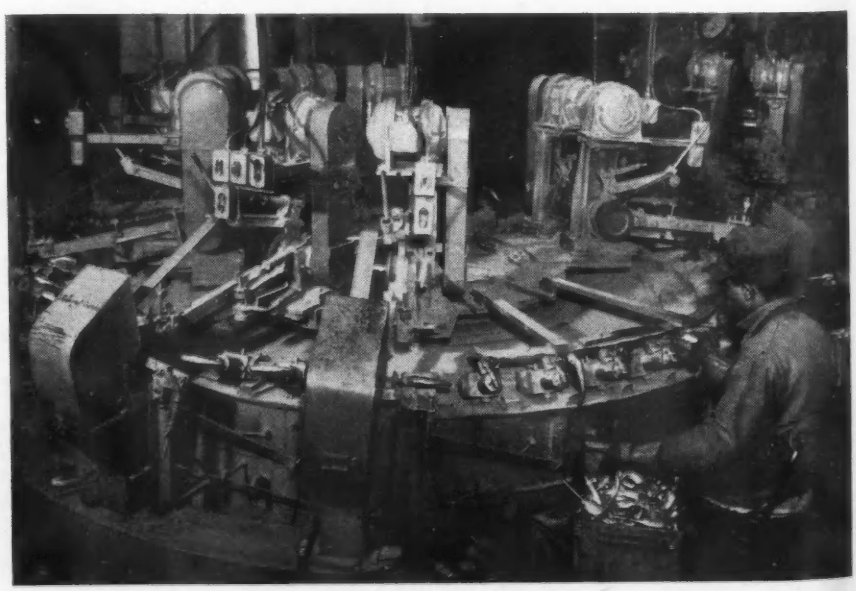
deg before they reach the second station to present the reverse side for finishing.

Monorail conveyors are used throughout the plant, particularly in the paint shops and electroplating departments. Unique example of shortening the path from fabrication to the shipping dock is found in the new installation of two spiral gravity roller conveyors for carrying packages from the third floor to the first floor, one of these being shown in the accompanying photograph. Other material handling devices employed in fabrication lines for assembling regulators, "CV" assemblies, hinges and locks are: combinations of hoppers with inclined belts; small sections of gravity roller conveyors; conveyor belts; and monorails.

The die casting department contains an unusual machine for polishing door handles. It has a pair of inclined plates at each station, forming an open "V," with a vertical hinged work-holding fixture in between. The operator stands at the loading station and loads handles into the automatic clamping fixtures. By means of a cam arrangement, each fixture drops side-wise to rest the work on the inclined plate while riding under a series of wheels, thus polishing one side. Then, at another point, the fixture swings in order to rest the work on the opposite plate, presenting the other side to the wheels.

The line drawing in this article shows the elevation and end view of one of the regulator lines in the die casting division. The arrangement is quite typical in basic principle and is developed for other lines in the plant in accordance with the special requirements of each one. Looking at the elevation, work is dumped into the hopper (1) and transported by the inclined conveyor belt (2) into hopper (3). It is then distributed to each of the two presses (4 and 5) by chutes. From the presses work is carried to each of two portable hoppers (6) by an inclined conveyor belt. The portable hoppers, when loaded, are rolled over to tapping machines (7 and 8) and parts then are delivered to the washing machine (9) by an inclined conveyor belt.

The end view shows how mechanical devices are employed for distributing work from one operation to several stations doing the same job. Here the parts go through the washer (9); are unloaded into gravity chute (10), and transported by the inclined conveyor (11) to station (12) from which they drop into hoppers on each side through the inclined chutes. From this point the parts move to other operations.



Typical of the small rotary polishing machines developed at Ternstedt is this unit, one of many similar machines in the die-casting department. The operator is loading and unloading door handles.

Fig. 1—Schematic diagram of dynamometer-torque indicator.

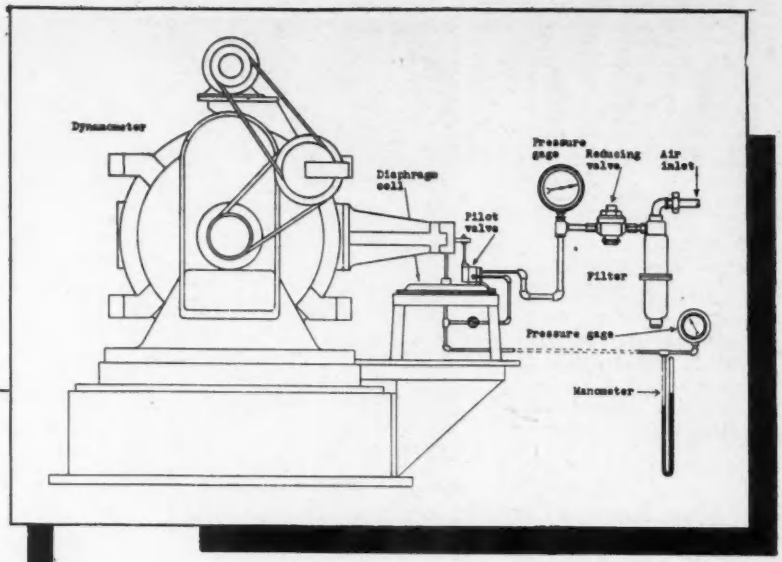
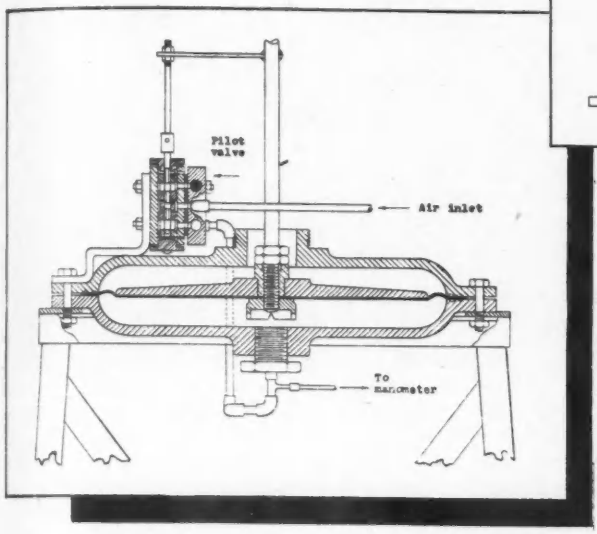


Fig. 2 — Cross section of diaphragm cell and piston-type pilot valve used in dynamometer-torque indicator.



Torque Measuring Device Utilizes Compressed Air

A BALANCED-DIAPHRAGM device for measuring dynamometer torque of single-cylinder or multi-cylinder engines, developed by the NACA Cleveland Engine Research Laboratory, utilizes automatically controlled compressed air as the balancing and transmitting fluid to provide a means of obtaining torque measurement at a remote position.

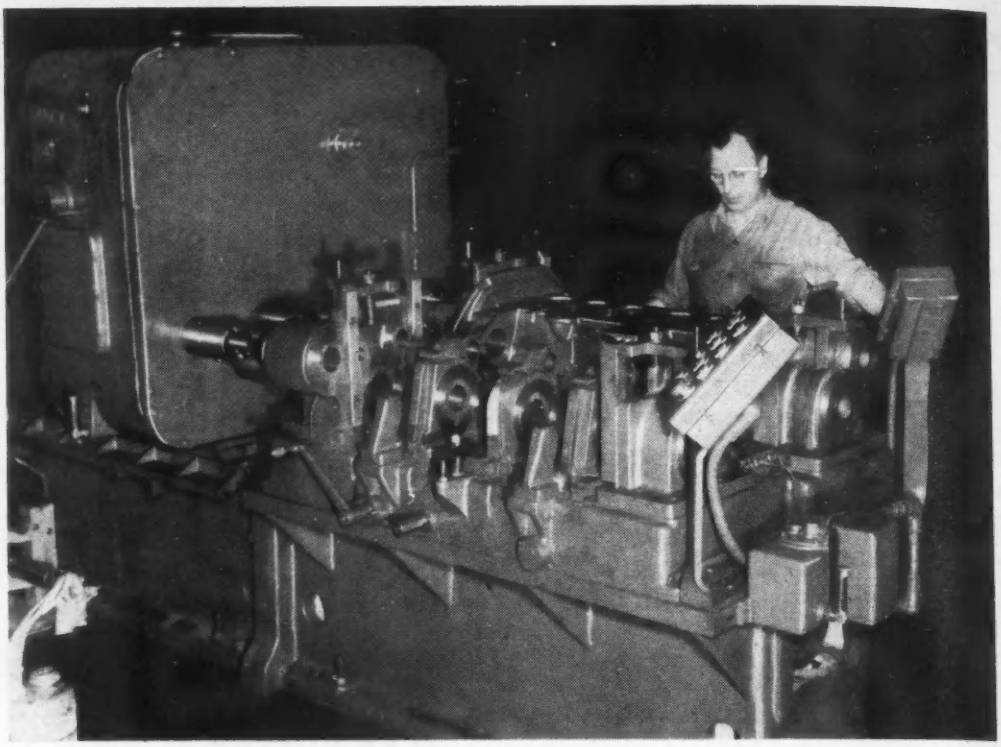
A schematic layout of the device is shown in Fig. 1. The dynamometer-torque load on the diaphragm is balanced by air pressure introduced through a pilot valve. Laboratory service air passes through filters and a pressure-reducing valve to the pilot valve that moves with the diaphragm and admits compressed air when the torque increases and permits escape of the air when the torque decreases. The diaphragm thus remains balanced in practically the same position under all conditions of load, with loading restricted to one direction. The torque measurement is obtained from a manometer reading that indicates the air pressure under the diaphragm. Fig. 2 is a sketch of a section through the diaphragm cell and the pilot valve shown in Fig. 1. The diaphragm used is of 0.03125 in. Neoprene-impregnated fabric. Air pressures as high as 25 psi have been used on this material. The pilot or balancing valve shown in Fig. 2 is a commercially available piston-ported spool valve. It is essential that the intake and discharge ports open with a throttling effect in order to avoid excessive movement of the diaphragm and possible hunting.

For accurate measurement of dynamometer torque in engine testing, an indicator movement of not less than 0.10 in. per unit has proved satisfactory provided that observations can be made at close range. This requirement makes it necessary to have an indicator with a scale length of 30 or 40 in.; thus a manometer is an ideal instrument for this purpose. In order to eliminate use of a single manometer with a scale more than 40 in. in length, well-type manometers can be placed in parallel. In this case the tubes of all manometers are extended upward to cover the entire range, and the scale of the first manometer indicates the first 40 in. For each successive manometer the well is lowered so that the scale indicates the successive 40 in. interval.

The use of air as the transmitting medium makes it convenient to locate the manometer at any desired elevation with respect to the diaphragm without the necessity for a correction in pressure head. The use of air for transmission, furthermore, makes it readily possible to connect two or more remotely located indicating manometers in parallel and, where the tests require a complete time history of the torque, to pro-

(*Turn to page* 94, *please*)

The foregoing article was abstracted from the NACA report RB No. 4C28, "The NACA Balanced Diaphragm Dynamometer-Torque Indicator," by Charles S. Moore, Arnold E. Biermann, and Fred Voss, Aircraft Engine Research Laboratory, Cleveland, Ohio.



Here is the massive W. F. & John Barnes crankcase boring machine recently installed by Autocar.

Autocar Installs Special Machine For Boring Crankcases

RECENT acquisition in the Autocar plant is this new W. F. and John Barnes boring machine, a massive but flexible piece of equipment for boring crankcases for a large and a small engine. It can be arranged to rough-, semi-finish, or finish bore a group of seven main bearing bores, five camshaft bearing bores, one idler shaft bore, one accessory shaft bore and one generator hole, holding close tolerances on the bore centers. Although the machine is designed to handle two sizes of cases, only one style can be machined at a time.

The hydraulic mechanism and electric control are operated by a push button system designed to make the function of the machine completely fool-proof. The machine will not start until the boring bars are in proper position and the case clamped correctly.

A special "rise and fall" type fixture is fastened to the main bed to properly locate and hold the crankcases and boring bars. It is equipped with preloaded ball-bearing guides for the boring bars, the guides being slotted so that the boring tip will pass through while positioning the bars. When the case is loaded it is raised off the true boring bar center so that the bars with their inserted boring bits can pass through the various holes with clearance. After the bars have reached their proper longitudinal location to allow the individual tips to clear the casting, the case is dropped on its true center and properly clamped. Then, the machine is started to complete its boring cycle. When the boring cycle is completed, the bars are automatically indexed to proper circular position so that they can be extracted through the guide slots without shearing off the bits. Before the bars are extracted, the case is elevated off center so the bits do not scrape along the finished bores.

Boring bars are fitted with cemented-carbide-tipped adjustable boring bits (one for each hole), and for finish boring operate at a peripheral cutting speed of 250 fpm and a longitudinal feed of about 0.005 in. per revolution.

The following tolerances are held on the various bores:

Boring Center No. 1—Seven crankshaft bearing holes bored to 3.4985/3.4990 in. dia.

Boring Center No. 2—Five camshaft bearing holes bored to 2.7500/2.7495 in. dia.

Boring Center No. 3—One idler gear shaft hole bored to 1.8130/1.8115 in. dia.

Boring Center No. 4—One accessory drive shaft hole bored to 3.249/3.250 in. dia.

Boring Center No. 5—One generator hole bored to 3.249/3.250 in. dia.

Electronic Engine Tester Being Used by Dodge

A battery of 60 electronically controlled and automatic dynamometer test stands is being used by the Dodge Div., Chrysler Corp. for the automatic testing of car engines. A conveyor carries the engines directly from the engine assembly line to the dynamometer room. After mounting the engine's starter is tested; then the engine operates for five min at 500 rpm, at which time a hydraulically operated throttle opens up automatically, and the engine drives an electric generator for 12 min at half load. To finish the test, the engine is placed under full load. Indicators on the stand show the functioning of fuel, oil and water pumps; show that correst oil pressure is maintained, that thermostats are working, and that the carburetor is in correct adjustment. Further checking reveals that the clutch, transmission and Fluid Drive meet performance standards. Instrument panel dials also indicate the condition of ignition timing, spark plugs and distributor.

New Production and Plant EQUIPMENT

B-37—Improved Line of Spot Welding Machines

An improved line of 30, 50 and 75 kva pedestal type spot welding machines has been introduced by Progressive Welder Co., 3050 E. Outer Drive, Detroit. While designated as "economy" type machines, they are not 'light duty' in design.

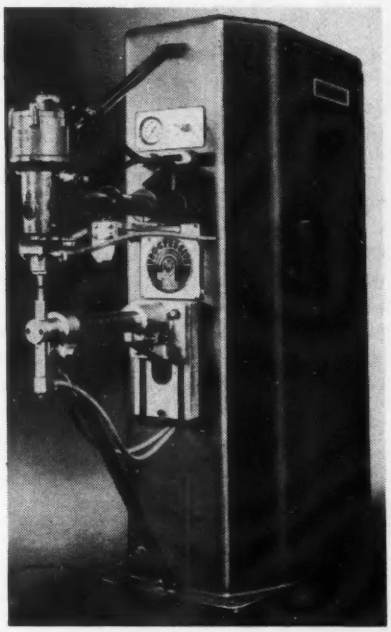
Frame construction in these machines has made possible a degree of accessibility not usually found in resistance welding machines. By concentrating the strength in the frame at the front of the machine—where rigidity is needed—it has been possible to use a light sheet metal construction for the rear of the machine.

Removable sheet metal panels and a full length door on the left side provide complete accessibility to all units contained in the machine, including transformer, heat controls, water piping, etc. The right side of the machine column is completely clear so that it can be used for side mounting of electronic or other welding controls.

The machines are designed to provide both adaptability for job welding runs and high output rates. To facilitate miscellaneous spot welding, knees are quick-adjustable, maximum stroke is unusually high (2½ in.) and different types of interchangeable electrode holders are available.

The welding head is of low inertia, for fast action. Maintenance of constant machine performance is aided by the feature of visible water circulation through three separate supply systems —one for each electrode, one for the transformer.

Welding arms are of large diameter, extending the frame rigidity right to the electrode point. For deep throat machine support, arms bracing the welding arms are recommended by the manufacturer to obtain maximum benefit from the rigid frame.



Progressive pedestal spot welder

B-38—Automatic Roll Selector

An automatic hopper-fed roll selector for 100 per cent inspection of length and diameter of small precision parts such as roller bearings, dowel pins, chain links and similar products has been developed by the Sheffield Corp., of Dayton, Ohio. It can be adjusted to permit an infinite number of different sizes of parts within the capacity of the machine to be gaged to a tolerance of .0005 in.

The flexibility which permits such a large number of different size parts to be gaged is accounted for by its range of adjustment, 7/32 in. to 31/32 in. on diameters and from 9/32 in. to 3 in. on lengths. The instrument requires only a brief time to change from one set-up to another.

After setting up the automatic roll selector, using minimum and maximum masters or two parts known to be the correct size, the parts are placed in a hopper. All of the hopper or feed rails that contact the parts are made of proper material to prevent the parts from congesting due to residual magnetism.

A reciprocating device picks up the units, and by means of a gravity fed slide they proceed to the gaging position. One Electrichek gaging head checks the overall length while two other gaging heads check the diameters at each end. During the gaging operation each part is classified and segregated into one of four classifications—parts within tolerance limits, diameter within tolerance limits and length oversize, oversize on diameter, and undersize on either or both diameter and length. Chutes are used to pass the segregated parts into separate bins.

The automatic roll selector illustrated

Sheffield automatic hopper-fed roll selector that will check and segregate 3600 parts per hour

NEW Production and Plant EQUIPMENT

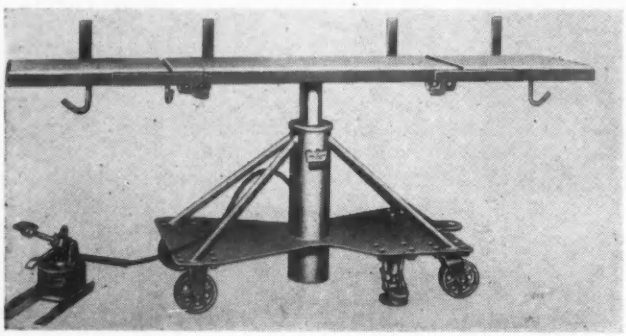
operates at a fixed speed to check and segregate 3600 parts an hour into the four classifications while gaging the three dimensions simultaneously.

B-39—Turning and Threading Machine

A new machine, designed and manufactured by Baker Brothers, Inc., Toledo, Ohio, employs an unusual method of handling, turning and threading on a high-production basis.

This is Model 30 HH, a two-way opposed, floor-type unit machine for operations on steering-knuckle pin upper arm support. Each unit is furnished with a four-spindle fixed center multiple head for hollow milling and chamfering, and heads provided with two additional drivers for operating lead screw spindles for external threading, using collapsible die heads. Lead nuts for the threading operation are mounted on the fixture uprights. These uprights also carry tool support bushings for supporting tools at cutting stations two and three.

Both heads are arranged with double motor-drive; one for the four spindles, and the second motor with reversing controls for the advance and withdrawal of the lead screw. This machine is furnished with a four-station, hand-indexed trunnion fixture; each station arranged to accommodate two parts.



Lyon-Raymond hydraulically operated strip and sheet feeding table

B-40—Hydraulically Operated Table

For feeding strip or sheet metal to shears, rolling mills, punch presses, and similar applications, Lyon-Raymond Corp., 3371 Madison St., Greene, N. Y., now offers a specially adapted hydraulic elevating table. This table is designed to accommodate bundles of stock, loaded by means of overhead hoists or fork trucks. Its elevating feature will enable a machine operator to keep stock at the desired height for feeding into dies or shears and will eliminate manual handling and the bending of stock.

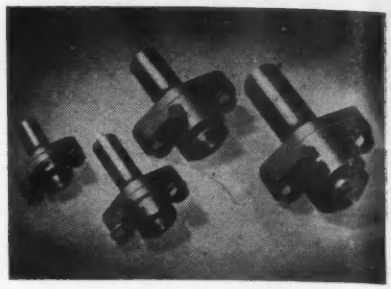
Since this strip and sheet feeding table is portable, it can readily be moved with stock to another press in case of die breakdown. The pump is joined to the central cylinder by a flexible hose which permits placing of the pump where it is most convenient to the machine operator—it may be suspended from the table top when it is necessary to move the table.

The table top consists of one rigid section, of the same length as the base, plus two removable extensions designed to support longer loads. If it is desired to store the table in a minimum space the extensions are removed by lifting to a vertical position.

B-41—Floating Tool Holders

A complete line of all-steel precision floating holders it has been brought out by Barnaby Manufacturing and Tool Co., 70 Knowlton St., Bridgeport 8, Conn. These holders, of conventional design, are now available in shank diameters of ⅝ in., ¾ in., 1 in. and 1¼ in.

Barnaby floating holders provide a ready means for aligning drills, reamers and similar tools with the work. The cutting tool is held in the head of the holder, either directly or by means of a bushing, and is clamped by a hardened steel set screw. One Barnaby hinged-shoe bushing blank is furnished with each floating holder.



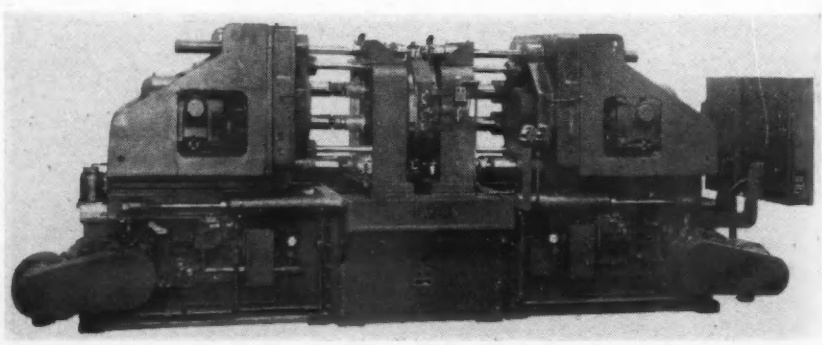
Barnaby precision floating holders

B-42—Material Handling Equipment

Information concerning an innovation in material handling equipment, which eliminates manual emptying of steel boxes and tubs filled with small parts has been released by the Monroe Auto Equipment Co., Monroe, Mich.

Known as the drop-bottom skid box, the new unit accomplishes the emptying job by gravity through a hinged bottom supported by two heavy, removable pins. Contents of the box—forgings, castings, stampings, screw machine parts or other small parts—may be unloaded to floor or work table without the necessity of the worker reaching into the box or bending over to the floor of the box on the inside.

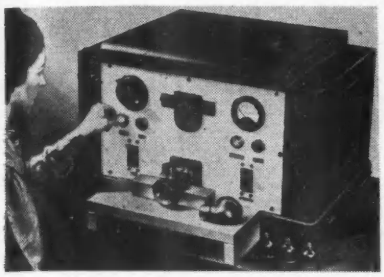
The new boxes, which may be used with ordinary lift trucks, are constructed of corrugated hot rolled steel, and, are available in six sizes with capacities ranging from 1500 to 4000 lb. Each box is equipped with skids for floor unloading. Offered separately as companion equipment are stands to hold the boxes at a height of 41 in. and provide handy waist high work tables to hold materials released when the boxes are emptied. These stands, constructed of heavy-duty angle iron, are supplied in sizes built for tiered loads from 4,500 to 12,000 lb.



Baker machine for operations on steering-knuckle pin upper arm support

B-43—Bench Type Induction Generator

Latest addition to the line of the Induction Heating Corp., 389 Lafayette St., New York 3, N. Y., is the Ther-Monic Model 43, a 750-watt, low-cost, bench-type induction heating generator. This unit is ready for operation immediately upon delivery by plugging into any 120-volt, 60-cycle, single-phase power supply outlet. The Model 43 derives its model number from the standard Ther-Monic method of designating a unit according to its full-load output, which is 43 BTU per minute. This is equivalent to approximately 750 watts at a nominal operating frequency of 450 kilocycles per second. The Model 43 combines the power section and work applicator in one unit. It provides a source of high-frequency energy for hardening, brazing, soft-soldering, annealing and melting operations. It is engineered for continuous full-load operation or for short run work. The coil leads are designed to facilitate frequent work change-overs involved in spot production, experimental or toolroom jobs.



Ther-Monic bench-type induction generator

The tube complement consists of one standard, heavy-duty, air-cooled, shock-mounted oscillator and two standard rectifier tubes.

The controls provide for automatic or manual operation. They include an automatic reset timer, start and stop control push buttons, on and off switch and plug connection for footswitch control of heating cycle. The indicating instruments consist of a plate current ammeter and plate and filament supervisory lights.

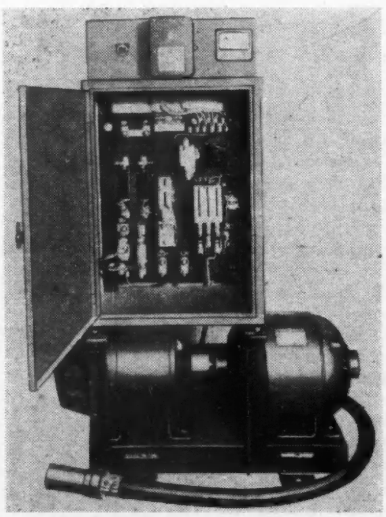
B-44—Heavy Duty Battery Charger

Improved heavy-duty battery charging equipment for industrial truck service has been placed on the market by the Motor Divisions of the General Electric Co. The equipment is packaged into one unit consisting of a single-circuit battery-charging motor-generator set, with its control cabinet mounted on a welded structural steel framework directly above. It is completely wired and assembled before shipment from the factory.

The equipment meets the requirements of an 18-cell, 550-amp-hr, lead-acid type storage battery. It charges the battery at the exact tapered charge rate that is indicated by the battery manufacturer as being necessary for longest life of the battery equipment.

The generator is a conventional 47-volt d-c machine. For exact adjustment of voltage, a slide-wire type resistor is used in the field circuit.

The equipment is completely automatic. Connection of the battery to the terminals automatically starts the motor-generator set, and when it has attained synchronous speed the line contactor to the battery circuit is closed automatically. As soon as the battery has reached a voltage representing 75 to 80 per cent of full charge, a timing device is actuated which cuts off the battery from the charging circuit on completion of the charge. This shuts down the motor-generator set and prevents overcharging the battery.

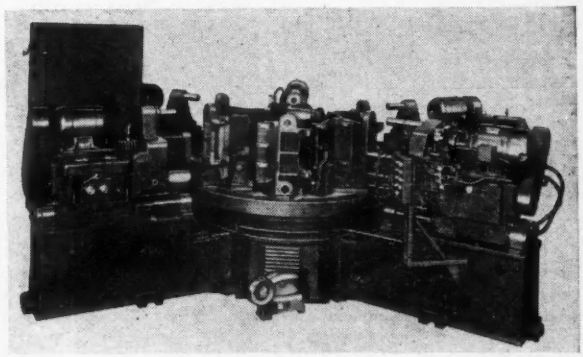


G-E battery charging equipment

B-45—Special Machine Handles 22 Operations

Twenty-two machining operations are performed on cast iron steering gear housings in this special automatic machine designed and built by Snyder Tool & Engineering Co., of Detroit. Drilling, boring, champfering, spotfacing, reaming and tapping operations formerly handled on separate machines are combined in a completely automatic cycle.

Work-holding fixtures are mounted on an electrically driven, automatic, six-station Geneva index table, and housings are machined by five self-contained Snyder machining units. Parts are clamped manually.



Special Snyder automatic machine

B-46—Skilsaw to Make Pneumatic Tools

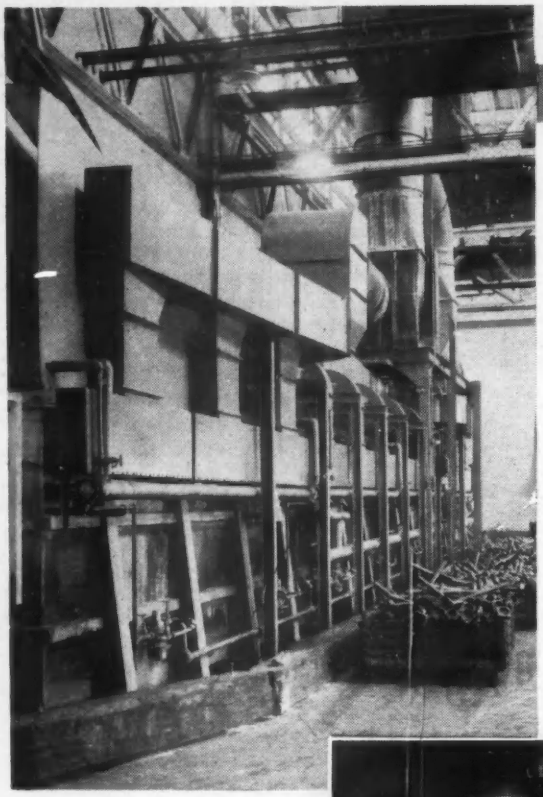
Skilsaw, Inc., 5033 Elston Ave., Chicago 30, Ill., recently announced its entrance into the pneumatic tool field with a new line of 28 models. These include pneumatic hammers, drills, screw drivers, nut runners, and die grinders.

The drills, screw drivers and nut runners are compact and light with no model longer than 7¼ in. or heavier than 2¾ lbs. These tools are constructed with six ball bearings, advanced design rotor and heat treated alloy steel gears and shafts. Optional speeds of 800, 1300 and 2100 rpm are available for the runners and drivers. A range of speeds from 800 to 10,500 rpm are available for the drills. The screw drivers and nut runners have a ball rolling adjustable clutch. The pneumatic grinders are available in three models, intended for die grinding, burring, rotary filing and use with wire size drills.

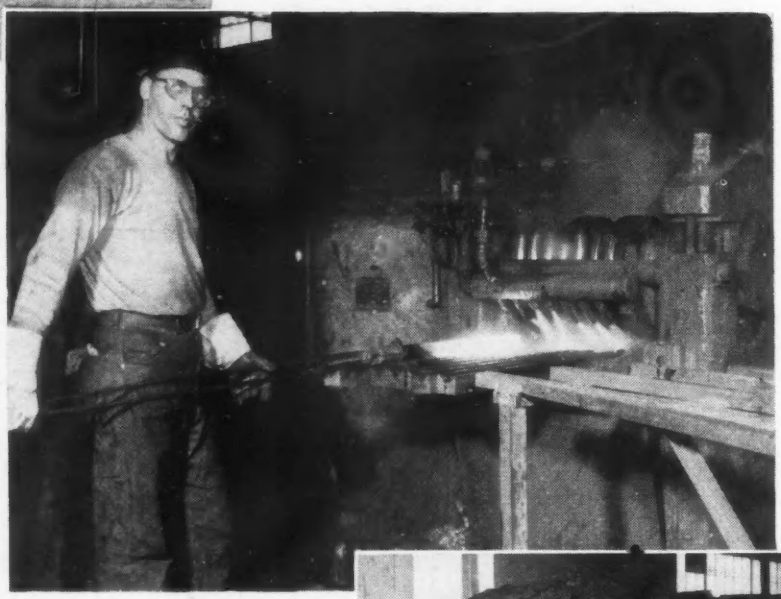
Free speeds of 25,000 rpm are said to be practical for uninterrupted use. Dimensions for the three models are: Seven in. long, 1½ in. diameter and slightly over 1 lb in weight.

(*Turn to page 86, please*)

Forging Developments at Oldsmobile Plant



(Above) A recent improvement in forging practice is this continuous conveyor-type pickling tank at the Oldsmobile forging plant. The huge tank measures approximately 60 ft in length, and includes a cold rinse and a neutralizing bath at the terminal end. Material is loaded on a monorail conveyor in the forge shop and is carried through the tank on this conveyor, not being handled until it reaches the rough inspection stations. This tank is used for pickling crankshafts, camshafts and axle shafts.



(Center) Another new Oldsmobile development is this barrel-type roll-forging machine for tapering and forming the splined-end section of rear-axle shafts. This operation is performed in seven passes under the roll.

(Right) Accurate control of forging temperature is obtained with this induction heater at the Oldsmobile forging plant, General Motors Corp., Lansing, Mich. It is used to heat all small-diameter billet stock, including square bar stock for forging connecting rods. In this photo, connecting-rod stock is being heated in preparation for the forging operation on a heavy three-station press equipped with two impression dies for producing two rods from a single piece of bar stock. The connecting-rod press, which is located near the induction heater, completes the forging operation in three passes. The forging is then trimmed in a small press, coined in another and is then ready for pickling or sandblasting.

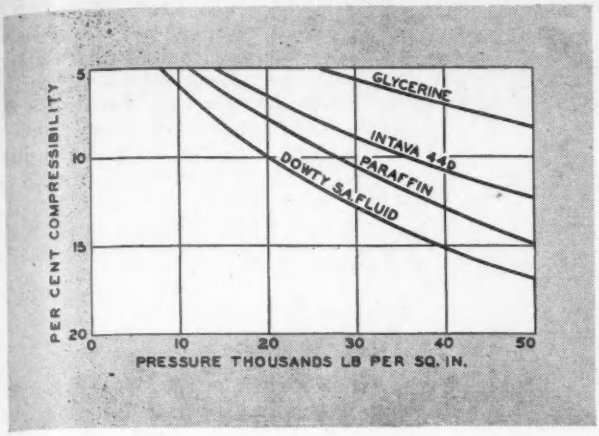


Fig. 1—Curves showing compressibility of liquids at pressures up to 50,000 psi.

"Liquid Springing" *for Motor Vehicles*

SUPPLEMENTING a recent disclosure by the Gabriel Co., Cleveland, Ohio, of plans to develop a new "liquid springing" suspension unit for motor vehicles, which appeared in the March 15, 1947, issue of AUTOMOTIVE AND AVIATION INDUSTRIES, page 192, additional details of this unique device are given here.

The basic "liquid spring" principle to be investigated by Gabriel, although never applied to motor vehicles except on several experimental cars in England, was developed by Dowty Equipment, Ltd. England, and supplied in large quantities for British military aircraft. Currently in use on the landing gear of many of the latest British planes, it is claimed that the springing principle has been perfectly adequate from the standpoint of aircraft service and manufacturing practice. Gabriel has a license to develop a smaller unit suitable for the suspension of motor vehicles and expects to complete this program within about three years. It is intended that this smaller unit will combine the functions of both a spring and shock absorber, thus providing space and cost economy.

The ability of the liquid spring to provide controllable spring characteristics depends entirely upon the compressibility of liquids. In that respect it seems to contradict the conventional viewpoint that liquids are not compressible. Nevertheless, the Dowty principle makes it possible to develop pressures within the cylinder upwards of 100,000 psi, the general level of pressure being around 50,000 psi for aircraft landing gear. It is likely that pressures in units for motor vehicles will fall below these values.

Research studies carried out in England show that certain types of liquids have considerable compressibility at these high unit pressures. This is demonstrated in the curves shown in Fig. 1. Dowty also has used silicone fluids, and it is quite likely that Gabriel will carry on experimental work with silicones before standardizing on the type of fluid to be employed.

As shown in Fig. 2, the device consists of a thick-walled steel cylinder completely closed at one end. The load is carried by a piston rod which passes through a bearing and a patented form of packing gland at the opposite end. The cylinder is filled completely with fluid while the piston rod and piston are in the extreme extended position. It can be seen that spring action is obtained by the compression of oil in the cylinder as the piston rod is forced through the liquid.

(*Turn to page* 56, *please*)

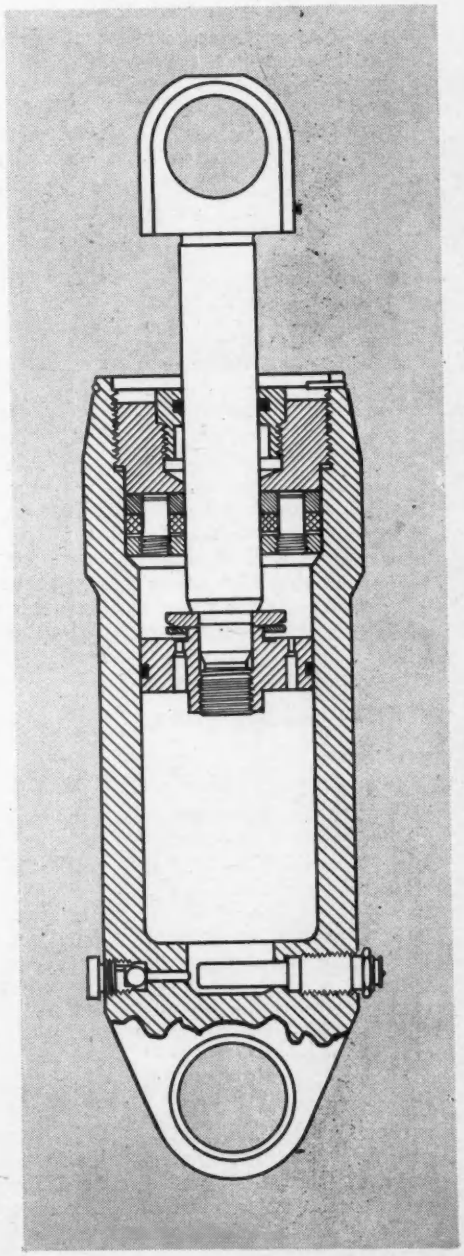


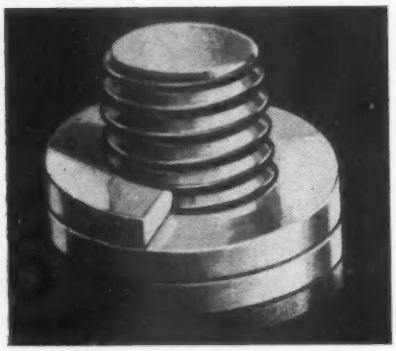
Fig. 2 — Cross-sectional drawing of the Dowty liquid spring assembly manufactured for aircraft.

NEW Products

C-54—New Type Spring Nuts

A new type of spring nut and a new spring lock nut have just been placed on the market by the George K. Garrett Co., 1421 Chestnut St., Philadelphia 2, Pa. It replaces the conventional nut and in one assembly operation assures a positive locking action on the bolt.

This new fastening device is made in two types. One replaces the conventional nut and is called the Diamond G spring nut. The other is made to supply action similar to a lock nut.



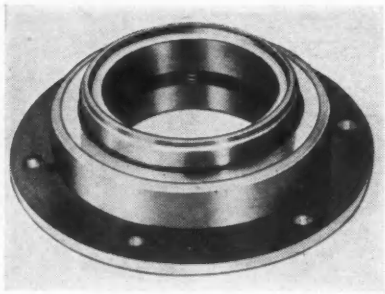
Garrett spring lock nut

The Diamond G spring nut is said to have all the advantages of a regular nut and is adaptable for use in "hopper-feeders" and various types of power wrenches. Because of precision manufacturing, it has greater gripping power on the threads of a screw or bolt and, therefore, resists loosening.

C-55—Carbon Ring Oil Seal

The Gits Brothers Manufacturing Co., 1846 S. Kilbourn Ave., Chicago, Ill., has just brought out a new high speed carbon ring oil seal, which is said to particularly suit those sealing applications where oil lubrication is at a minimum, where the seal runs in a liquid other than grease or oil, or where the shaft speed is greater than that satisfactorily served by a bronze ring although a good supply of oil is available.

The entire assembly, known as the Gits "DMC" and "DPC" high speed carbon faced seals, features a sealing principle that completely eliminates wear on the shaft and the need for replacement of grooved shafts.



Gits high speed carbon faced seal

These seals affect a seal against leakage of liquids or gases under pressure or vacuum by means of a radial seal joint made by positive contact between a stationary lapped seal surface built into the seal unit and a rotating lapped seal surface. They do not contact or wear the shaft surface, but transfer the wear to the radial seal joint instead.

C-56—Hammer with Nylon Head

A nylon soft-impact hammer that offers the advantage of not chipping, breaking, absorbing moisture or changing shape under hard use has been added to the line of the Herbrand Corp., Fremont, Ohio. Designed to afford a soft blow to the heaviest work, the nylon head absorbs impact and eliminates the possibility of personal injury by the rebound force. An interlocking head construction prevents the replaceable head from becoming loosened in use.

The new hammer is available in three sizes, No. 664 is a 32-oz. nylon hammer for heavier work such as body and fender repair. No. 662, a 20-oz. hammer, provides proper weight for fitting piston pins, gears, bearings, etc. For more delicate work on distributors, gears, bearings, etc., the No. 660 10-oz. nylon hammer is most effective.

C-57—New Series of Auto-Lite Spark Plugs

Now available for trucks is a new series of spark plugs manufactured by the Electric Auto-Lite Co., Toledo 1, Ohio.

The new spark plugs, called "Transport Plugs," are especially designed for long life and arduous service. They have a wider heat range than heavy duty types previously made by Auto-Lite by virtue of increased length of the firing tip on each range of the plug. Electrodes in the new spark plugs are heavier for longer gap life and are designed for longer periods of operation between cleaning and regapping. The new "Transport" insulator has higher thermal conductivity, higher mechanical strength and is extremely resistant to attack from lead in high octane fuels.

The plugs are available in 14 mm, 18 mm and ⅞-18 thread sizes.

C-58—Electrode for Alloy Steels

An improved Airco No. 190 electrode, which was originally developed for use by the aircraft industry in welding assemblies to be heat treated after welding, has been announced by the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.

The improved Airco No. 190 has two important advantages over its predecessor. One, when welding high strength chrome-moly aircraft steels, the necessity for preheating is minimized. Also, this electrode is less conductive to cracking adjacent to the weld area and between the layers of weld metal when preheating is not employed. This electrode will give tensile strengths up to approximately 150,000 psi and produce welds more ductile than those previously obtained.

Although particularly applicable to the aircraft field, this electrode can also be used on alloy steels where high tensile strengths are required.

C-59—Self-Contained Surface Comparator

Photron Instrument Co., 5713 Euclid Ave., Cleveland, Ohio, has placed on the market this light weight, self-contained surface comparator for production inspection of machined parts. The Pico comparator can be used on flat and round work, odd shaped pieces such as cams, thread flanks, and ball bearings. The exploring head consists of a light source, a lens system, and a light-sensitive cell. To obtain a reading, the hand-operated exploring head is placed on the surface being checked, the button pressed, and the meter reading compared with a previously prepared standard.

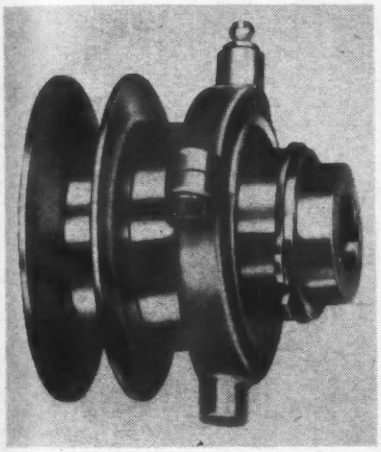
New PRODUCTS

Airco No. 190 electrode is recommended by the manufacturer for operation on direct current, straight polarity or on alternating current. The medium-long arc is suggested for best results. It can be obtained in 3/32 in., ⅛ in., 5/32 in., and 3/16 in. diameters.

C-60—Clutch for V-Belt Drives

The V-Belt Clutch Co., 3757 Wilshire Blvd., Los Angeles 5, Calif., is introducing a V-belt friction drive clutch designed to grip or release directly on V-belts. The "Ball-lok" clutch units, complete in themselves, may be used either as driving or driven pulleys.

In operation, the clutching action is the grip of the sidewalls of the pulley against the belt. When the clutch is opened, the belt slackens and idles on a free-running, grease-sealed, ball bearing, with no attendant belt drag or creep. One fixed flange of the V-belt sheave is an integrally attached part of the hub and the inner race of the sealed ball-bearing belt idler.



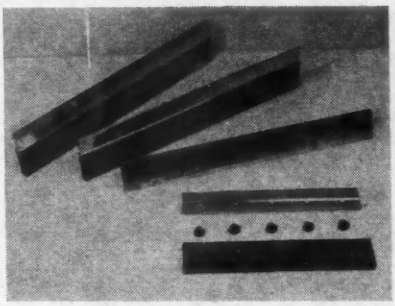
Ball-lok clutch unit

Four sizes in the present line have 3¼ in. to 5 in. sheave diameter, and are 2 15/16 in. to 3 1/16 in. in overall length. Two may be applied to ¾ in. shafts; two to 1 in. shafts. Weights range from 44 to 54 oz.

C-61—Bronze Blades for Centerless Grinders

The Foulk Manufacturing Co., 4208 Airport Rd., Cincinnati 26, Ohio, announce a complete line of Ampco bronze centerless grinder blades.

These centerless grinder blades are recommended by the manufacturer for use when grinding stainless steel, monel metal, aluminum or other materials that will "pick up" or score easily. Greater feed angles and regulating wheel rpm can be used with the Ampco centerless grinder blades. Although Ampco Bronze is said to outwear other blade materials such as cast iron normally used in grinding stainless steel, quick change insert type construction is used. One or two blade bodies may be used with many inserts to keep production moving at minimum blade cost.



Centerless grinder blades made by Foulk Manufacturing Co.

The new grinder blades are available from stock to suit most standard Cincinnati Centerless grinder work rests.

C-62—Cutting Oils for Oxygen-Free Copper

A new line of cutting oils which prevent discoloration during the machining of high-conductivity, oxygen-free copper has been introduced by the Socony-Vacuum Oil Co., Inc.

Designated as the "Cuprol" line, the new oils are being produced in two grades—one for high-speed operations, such as automatic screw machines, and the other as a replacement for and possessing the same viscosity as lard oil. Choice between the two is governed by cutting speeds of the machining equipment.

The oils were developed for machining of copper-base alloys containing more than 60 per cent copper and are adapted especially to such operations as drilling, tapping, threading and trimming of copper and copper-alloy parts for electrical equipment. In addition, they can be used as a replacement for lard oil in drawing and press-forming operations.

Service of the "Cuprol" line is limited for its non-staining qualities to highly-sensitive copper and copper alloys, with no claims being made as to general effectiveness in comparison with regular non-corrosive cutting oils in machining steels and other metals

C-63—Flexible Abrasive Sticks

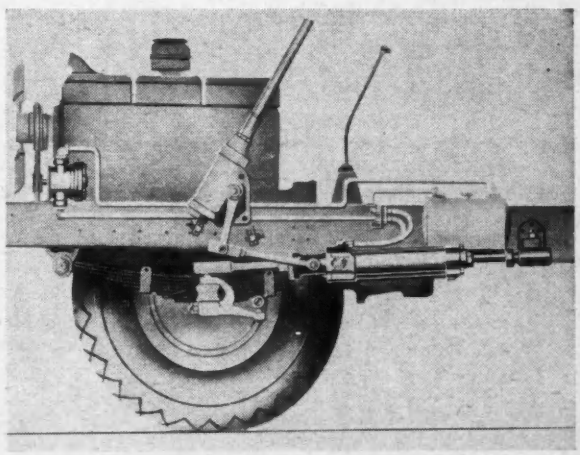
Sandusky Abrasive Wheel Co., 625 W. Ransom St., Kalamazoo, Mich., offers a new product—Sandusky flexible abrasive sticks.

These new flexible abrasive sticks are made of carefully graded abrasive grains bonded in rubber. They do not load or glaze and may be used dry or with water, it is stated.

In stick form, Sandusky rubber-bonded abrasive grains in three grades and in a wide variety of sizes and shapes are used for all kinds of light grinding, cleaning, deburring, rust removal, sharpening, honing, polishing, etc.

The company claims that it is very

C-64—Improved Power Steering System



This redesigned hydraulic power steering system is now in production at Vickers, Inc., 1428 Oakman Blvd., Detroit 32, Mich. It includes such new features as simplified installation, 13 per cent less weight, and more rugged and compact construction

NEW Products

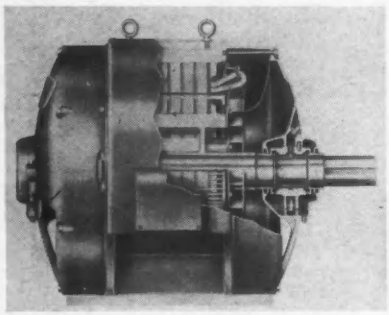
Continued

easy to shape Sandusky abrasive sticks for any contour. They can be cut with a jack-knife, file, grinding wheel, hacksaw, bandsaw, etc. This makes it possible to cut special shapes to fit the deburring, finishing, or polishing operation being performed.

C-65—Splash Proof Induction Motors

Electric Machinery Manufacturing Co., Minneapolis 13, Minn., is manufacturing a line of drip- and splash-proof squirrel-cage induction motors in sizes from 100 to 1000 hp and speeds of 1800 rpm and lower.

A fabricated steel frame shuts out falling particles, makes operation quieter, and invites easy cleaning.



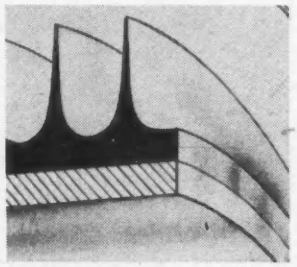
Cutaway view of the E-M "Heavy-Duty" drip-proof squirrel-cage induction motor

Inspection and blowing out are simplified on larger ratings with access plates designed for speedy removal and replacement. Sealed bearings can be cleaned and refilled without motor disassembly. Double end ventilation is provided by a blower on each end of the rotor. Starting characteristics are NEMA Class B for across-the-line starting.

C-66—Heavy Duty Brake Drum

An entirely new type of brake drum, for use on heavy aircraft, buses, trucks, and trailers, has been developed by the Copperweld Steel Co., Glassport, Pa.

New principles of drum design and new methods of manufacture are employed in the making of this brake drum, which has a friction surface of special wear-resisting alloy steel and an outside layer of copper with specially designed copper fins. Because of the high thermal conductivity of the copper, the Copperweld brake



Enlarged section of Copperweld brake drum

drum dissipates friction-generated heat to the atmosphere at a rapid rate—at the same time helping to maintain a more uniform temperature level over the entire brake drum surface.

C-67—Hammers with Plastic Tips

Ten new hammers with hard plastic tips and two with extra soft tips have been brought out by the Plomb Tool Co., 2209A Santa Fe Avenue, Los Angeles 54, Calif. These hammers use a plastic, known as Nuplaflex, which is intended for threads, for painted, polished and plated surfaces, and for any parts that would be marred, scratched or otherwise damaged by metal hammers.

Tips of the same size are interchangeable, so that a hard tip and extra soft tip can be used on one hammer. They are automatically locked when screwed into a head, but are easy to detach. Heads have a streamlined design. Hickory handles are octagonal.

C-68—Monel Ignition Cable

An ignition cable that takes advantage of the high tensile strength of Monel is now being delivered by the Clark Cable Corp., 11205 Berea Rd., Cleveland 2, Ohio. It is said to deliver more power to the spark plug in the firing chamber of an internal combustion engine and, at the same time, provide higher resistance to heat, oil, moisture and other destructive factors. The new ignition cable is now being made available for passenger, truck, bus, tractor, and other gasoline motors. Its small core diameter gives it low electrostatic capacity. Instead of the 19 strands in the conventional copper wire cable, the Monel cable has only 7 strands. Combined diameters of the Monel strands are less than half those of the copper. The overall diameter of both cables is the same, however, thus providing greater insulation for the Monel cable.

Because of the high strength and ductility of the alloy, it can be pulled and bent around corners without danger of fracture. It permits a tight bond with the insulating material and thus prevents the formation of air pockets. Fatigue resistance is such that it can withstand the effects of constant engine vibration.

C-69—Water Cooled Flexible Conductor

A new type water-cooled flexible conductor for transmission of high power, high frequency current is offered by Titeflex, Inc., 507 Frelinghuysen Ave., Newark 5, N. J.

Construction of the conductor consists of a brass, water-tight convoluted inner core with an outer braid conductor. A specially compounded high-frequency flexible insulation is extruded over the outer-braid. This new flexible conductor has the following features: Water-cooled for minimum losses at high power; insulation is suitable for high frequency currents, being flexible and tough, having excellent dielectric properties, chemical inertness, and excellent water resistance; flexibility permits freedom of motion between components; lower power losses than conventional ¼ in. copper tube.

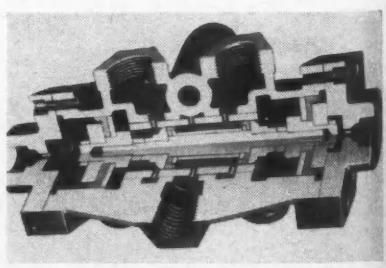
Application of the flexible conductor is said to be particularly adaptable to high frequency heating equipment or to any equipment where it is necessary to carry a substantial amount of power at high frequency.

C-70—Improved Air Control Valves

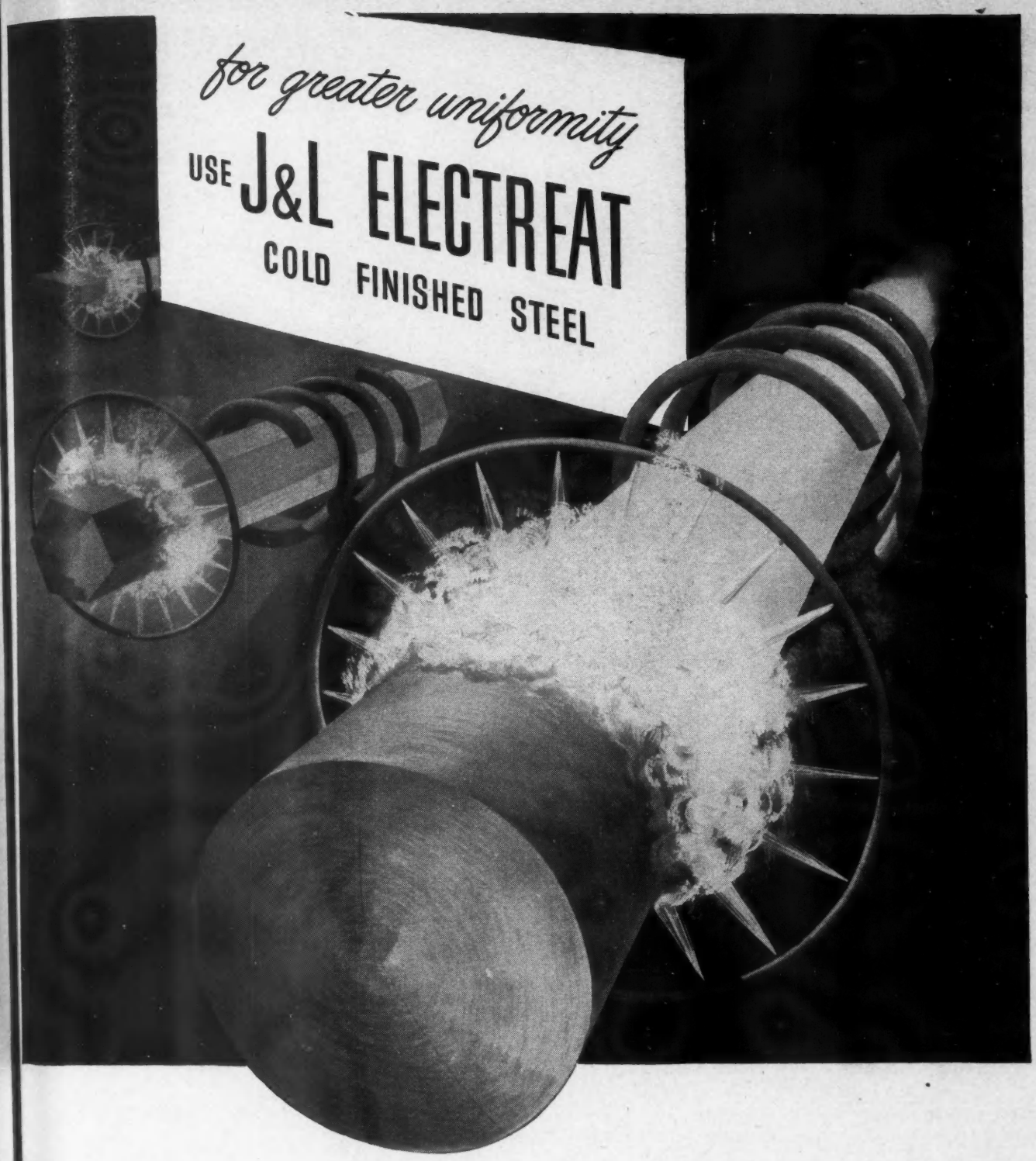
Completely re-designed and now available in 79 standard models, an improved line of air control valves is offered to the trade by the Logansport Machine Co., Inc., 905 Center Ave., Logansport, Ind. All valves in the line are designed for operation at pressures to 150 psi.

Effortless operation is said to be assured, because Logan air control valves do not operate against air pres-

(*Turn to page 67, please*)



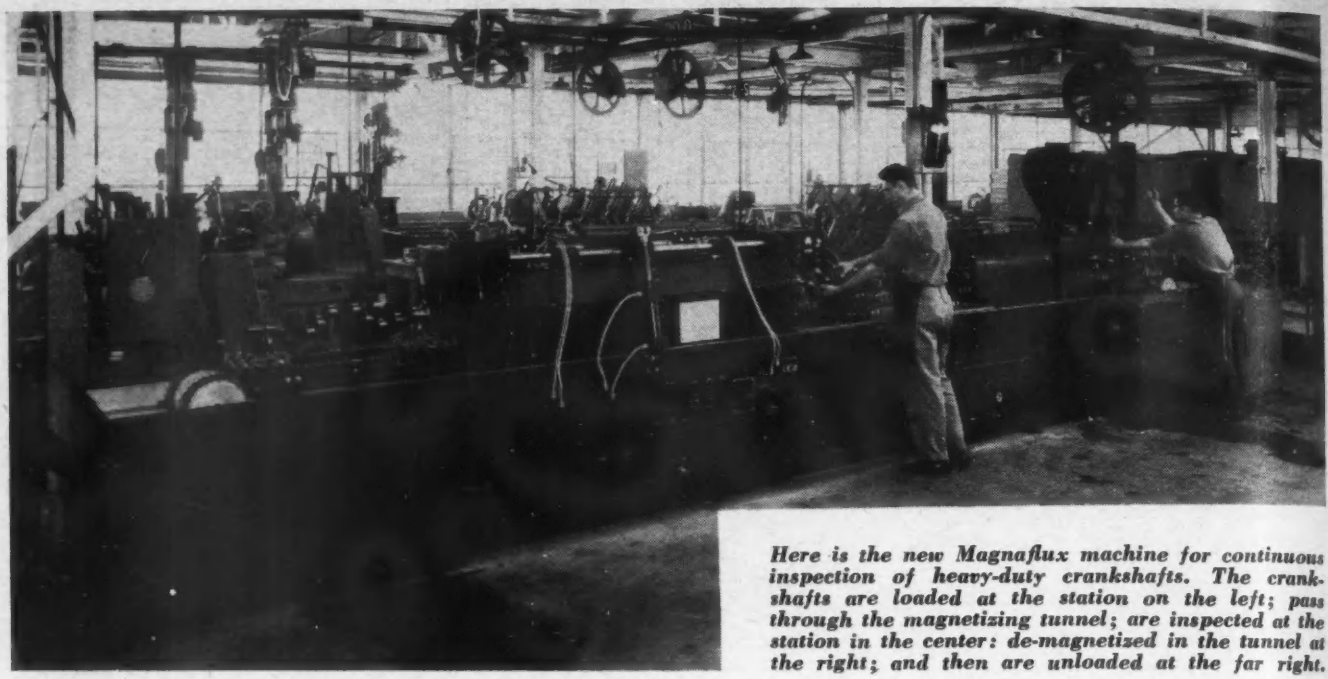
Cutaway of horizontal piston type Logan valve



The new induction heating method of producing heat treated quenched and tempered cold finished steel makes possible an unusually accurate control of the process. Bars are fed individually through the coil and heated to exactly the desired temperature. They pass immediately through a cone of water sprays which is used to closely regulate the cooling. The Electreat cold finished bars produced by J&L with this process have a degree of uniformity not possible with conventional methods. Write for complete information.

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION · **PITTSBURGH 30, PA.**



Here is the new Magnaflux machine for continuous inspection of heavy-duty crankshafts. The crankshafts are loaded at the station on the left; pass through the magnetizing tunnel; are inspected at the station in the center: de-magnetized in the tunnel at the right; and then are unloaded at the far right.

Magnaflux Machine

Permits Continuous Inspection

of Heavy-Duty Crankshafts

IN OPERATION at the Truck and Coach Div., General Motors Corp., Pontiac, Mich., is a new, 28-foot Magnaflux machine which permits the continuous inspection of heavy-duty crankshafts in about 40 different sizes. The inspection machine, illustrated on this page, is a single unit containing a chain conveyor fitted with 10 stations for an expected inspection rate of 60 shafts per hour. This rate can be varied, however, and possibly increased later on. Each of the conveyor stations has an adjustable fixture for holding any of about 40 different crankshafts. This machine is the first installation of its kind.

The Magnaflux machine consists, basically, of three stations for loading, inspecting, and unloading; a magnetizing tunnel; a de-magnetizing tunnel; and a continuous motion conveyor with 10 crankshaft fixtures. The inspecting station is equipped with a control panel; and the final station is provided with a limit switch to prevent movement of the conveyor if the operator is not ready to remove the shaft. Under full production conditions the machine will have three operators: one at each end for loading and unloading,

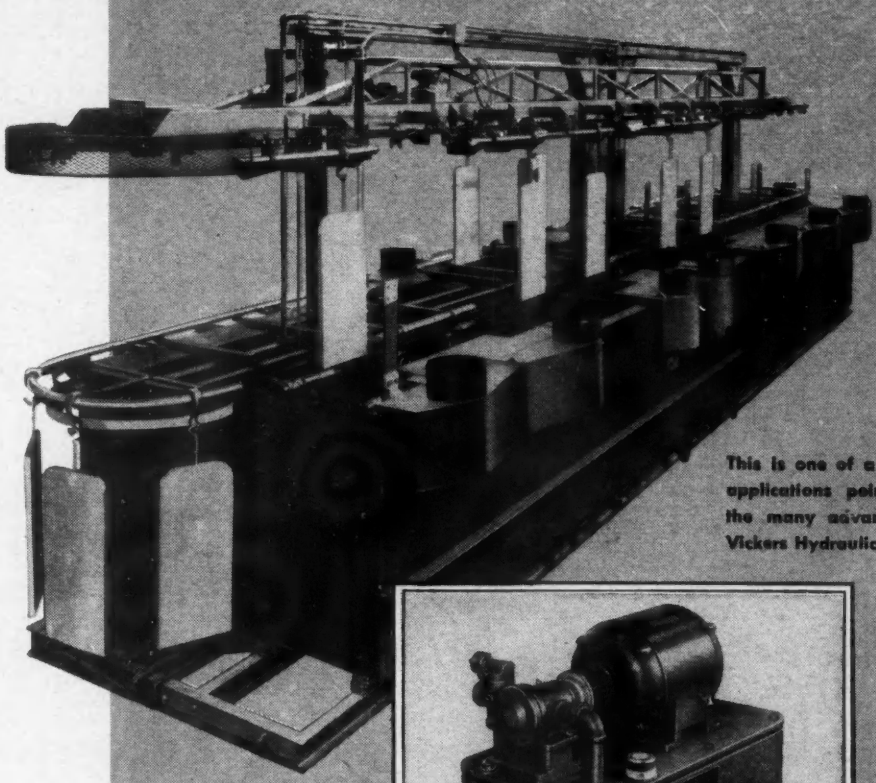
(*Turn to page* 82, *please*)

Close-up view of the Magnaflux machine's inspection station. The crankshaft is scanned rapidly while rotated on the end bearings.

VICKERS helps achieve HYDRAULIC EQUIPMENT

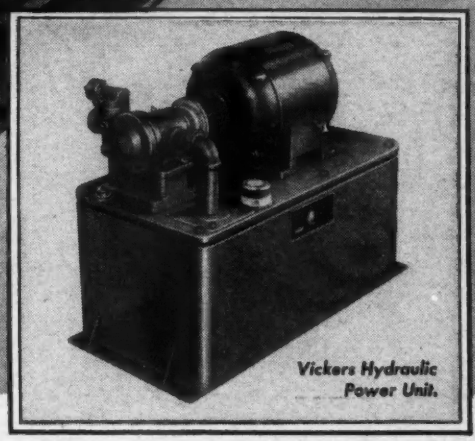
HIGH PRODUCTION
SPACE ECONOMY
UNIFORM QUALITY

IN *Udylite* AUTOMATIC PLATING MACHINE



This is one of a series of applications pointing out the many advantages of Vickers Hydraulic Controls.

Above: Elevated position for transfer from one tank to the next.



Vickers Hydraulic Power Unit.

This Udylite machine does a complete plating job automatically . . . taking each part through seven tanks and a drying chamber . . . timing exactly the interval in the various solutions for cleaning, plating and rinsing.

Each part (or rack of parts) is automatically lowered into each of the seven tanks in turn—then lifted out and transferred to the next tank. This might be done with a multiple dip conveyor. But the conveyor slants permissible in lowering and raising in that way require extra tank length.

Udylite made the machine far more compact—saving 18″ to 24″ in the length of each tank—by using Vickers Hydraulic Equipment to raise and lower the entire conveyor assembly at each transfer. By this means, each piece (or rack) is lifted straight out of the tank, moved over the next tank and lowered straight down. This provides better cleaning and more uniform plating—better drainage and less contamination of the solutions.

The Vickers Hydraulic Power Unit and Control Valves have many advantages for such applications: (1) proven dependability, (2) accurate control and precise timing, (3) flexibility of control to suit varied production requirements, etc.

The versatile features of Vickers Hydraulic Equipment on this type of application, as on many other industrial installations, have made possible increased production, improved product quality, greater safety, and lessened physical demands upon labor while increasing its productivity. Vickers Application Engineers will gladly discuss your individual control problems.

VICKERS Incorporated
Subsidiary of the Sperry Corporation
1428 OAKMAN BLVD. • DETROIT 32, MICHIGAN
Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI
CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA
ROCHESTER • ROCKFORD • SEATTLE • TULSA • WORCESTER

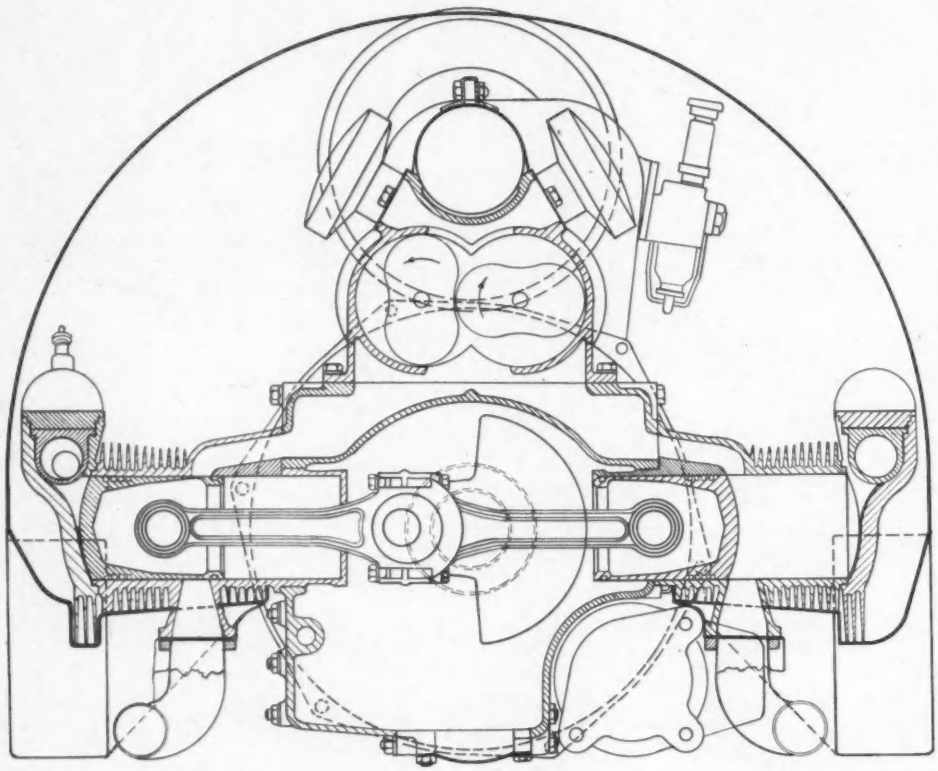
New BULLETIN

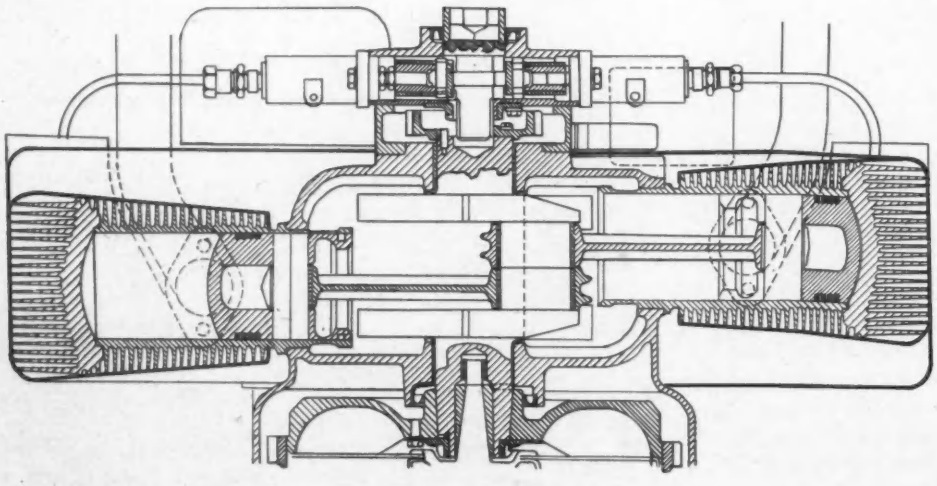
Write for Bulletin 46-43 describing Vickers Hydraulic Power Units.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

A Diesel *for the* Volkswagen

THE two-cylinder Diesel engine described here was designed by the Germans to replace the four cylinder (60 cu in. displacement) gasoline powerplant of their Volkswagen. It is a two-stroke, horizontally-opposed, air-cooled compression ignition engine. The air-cooling system was similar to that already employed on the Volkswagen, but using an axial blower instead of a radial one. The design further called for a Roots supercharger and two Bosch injection pumps. Its design was completed in May, 1945, but the engine did not go into production, nor was a prototype built, before the war ended in Europe. Design specifications and drawings of the engine are given on this page.





Specifications

Bore	3.346 in.
Stroke	3.937 in.
Displacement	34.63 cu in.
Compression ratio	17.5 to 1
Maximum output	24.7 hp at 2400 rpm
Continuous rating	21.7 hp at 2000 rpm
Maximum torque	60 lb ft at 1600 rpm
Scavenging	Reverse
Reduction of crankshaft	1.32 to 1
Weight (without starter or battery)	221.5 lb

Drawings of the two-stroke air-cooled Diesel engine designed for the German Volkswagen. Auxiliary starting equipment includes one glow plug per cylinder and a Bosch starter. The cylinders are of special gray cast iron, with cylinder heads and pistons of light alloy metal

POWER

EXIDE... THE DIESEL CRANKING BATTERY OF EXTRA POWER AND RUGGEDNESS . . .

When Exides do the cranking, Diesel engines start. Exides have the extra power this tough cranking job demands. Their sturdy construction is equal to the exacting cranking needs of all Diesel-powered equipment on both off the highway and on the highway.

That's why so many thousands of them are used not only where conditions are normal but also where climates are exceptionally severe.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

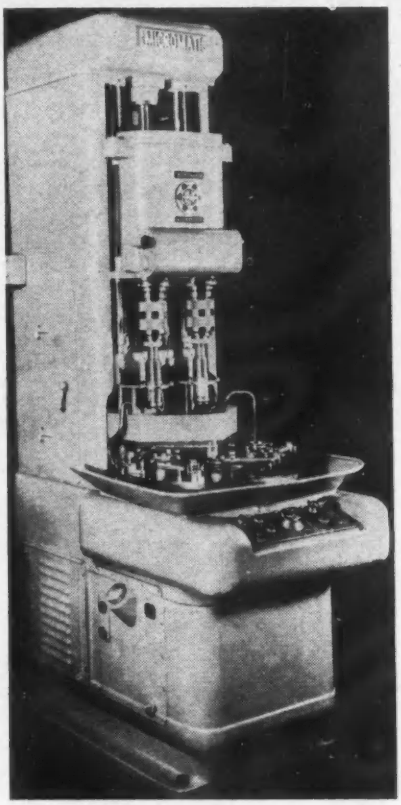
Connecting Rod Honing Machine

FITTING into its present program of applying advanced techniques to the improvement of quality and increase in productivity, Ford Motor Co. is production-testing the first installation of a new connecting rod big-end honing machine built for the purpose by Micromatic Hone Corp.

As illustrated, it is an adaptation of the Hydrohoner Microsize principle, and represents the first disclosure of electronic control of precision sizing of the honing tools. The machine has two spindles, one for roughing, the other for finishing. Both are in operation simultaneously but each is individually controlled in its sizing cycle. The table is of rotary indexing type with six stations, each station holding two con rods at a time, both being honed simultaneously.

In operation the machine cycle is completely automatic, function of the operator being to load and unload the work in the fixtures. Final sizing is on an extremely high level—total tolerance on the bore being held to 0.0005 in. Ultimately one of these machines will replace two of the older machines. The latter are simple-spindle machines, holding four rods at a time but doing either roughing or finishing in each set-up and thus requiring a pair of machines to complete the operation.

Some years ago the older machines represented the most advanced form of equipment for mass production honing of connecting rods. Now they give way to a better method typical of current progress in this field.



Here is a view of the Micromatic connecting rod honing machine taken before it was installed in the Ford Motor building. The spindle at the left is for roughing; the one at the right for finishing.

Indianapolis Race

(*Continued from page* 30)

tubular cross frame member. There are two trailing links, the bottom one being attached to the torsion bar and the upper one to a Luvax hydraulic shock absorber.

Brakes are Lockheed all around, with two leading shoes and a separate cylinder for each shoe. Drums are heavily ribbed. There is an air scoop at the front and a release slot at the rear. The layout allows the rear brakes to be operated hydraulically by hand. Originally the car had tubular oval-section frame members. As these did not provide sufficient rigidity, another half-section tube was welded on, forming the present 8-section, which has proved satisfactory.

Wheelbase is 103 in., tread 52 in. and weight (dry) about 1450 lb. The rear gasoline tank holds 38.5 gal. The single seater body is made of aluminum. A feature is the fitting of the oil capacity indicator flush on the side of the body, so that it can be read by the pit mechanics. Only three instruments are carried: revolution counter, oil pressure gage and water temperature gage. This car has been timed at 172 mph.

Remainder of the entries, which ranged from the well-proven Bennett Brothers Special to the several Ford-powered creations, are summarized in the specification table.

Liquid Springing

(*Continued from page* 47)

Damping is accomplished by suitable valving and orifices in the piston to provide any degree of resistance to the movement of the piston in either direction, thus combining the functions of a spring and shock absorber. It may be noted at this point that, as the piston moves into the liquid, there is a transfer of the liquid from the upper chamber to the lower chamber through the piston head.

One of the most important features of the device is the high-pressure sealing gland which seals the open end of the cylinder and permits smooth movement of the piston rod while subjected to enormous pressures. The gland is of the unsupported area type, and is located between a step in the cylinder bore and a gland retaining nut. The gland assembly is made in three sections. A steel pressure plate carrying four dowel pins butts against the cylinder step, the pins passing through a synthetic rubber ring and into holes in a backing plate. A retaining nut supports the backing plate while a thin disc placed between the gland and pressure plate prevents pressure lock. Colloidal graphite is added to the oil to reduce friction. With this design the cross-sectional area of the resilient member is less than that of the pressure plate, owing to the area displaced by the four dowel pins. Consequently, the pressure on the plate is intensified on the gland thus giving the resilient member the tendency to "leak" into the gland rather than permit the oil to leak out.

Rolls-Royce Engine

(*Continued from page* 35)

valve, is provided to maintain automatically the boost pressure determined by the throttle control lever.

Lubrication follows usual Rolls Royce practice, with the main bearings and the connecting rods lubricated from the hollow interior of the crankshafts, the oil being fed in at each end of the shaft. Magnetos are two Duplex type BTH—CT—12A, the firing order (two cylinders firing simultaneously) being as follows:

(1A 6D) (5B 2C) (4A 3D) (1B 6C)
(2A 5D) (4B 3C) (6A 1D) (2B 5C)
(3A 4D) (6B 1C) (5A 2D) (3B 4C)

The reduction gear housing has an extension at the forward end to house the thrust bearing of the propeller shaft, the shaft being lengthened to bring the contra-rotating propellers well forward of the main bulk of the engine. An unbroken cowling is thus obtained, with the major portion of the engine well inside the fuselage. Reduction ratio is .2985/.2985, with contra rotation, the inner shaft (viewed from rear) being anti-clockwise and the outer shaft clockwise.

Contract dry weight of the engine is 3900 lb. Maximum rpm is 3500, and cruise rpm 3100, the maximum bmep being 282 psi, power per litre 76, and power per sq in. piston area 6.375. Maximum consumption is 350 gal per (Imperial) at 14250 ft F.S. combat; take off consumption is 342 gal per hr. at sea level; climb consumption 176 gal per hr at sea level M.S., and maximum cruise consumption 142 gal per hr. at sea level M.S.

WHO'S NEXT

to improve a product

WITH MONEL?

ATTENTION PURCHASING AGENTS: MONEL is readily available

There are good reasons why the Electric Auto-Lite Company of Toledo, Ohio — one of the largest manufacturers of automotive distributors — specifies Monel* for their product's rotor arms. Once you read about the added service and reliability that these Monel parts provided, you'll probably want to see how it can be used to improve your own product.

Monel offers these important advantages in automotive ignition applications:

- **SPECIAL PROPERTIES** — Monel successfully withstands the extreme wearing action imposed on rotor arms. It is also highly resistant to spark erosion and the action of nitric oxide and other corrosives that endanger distributor service life.
- **LOW UNIT COST** — Per completed distributor, Monel rotor arms cost about 1/10 of a cent more than competitive materials.
- **EASY FABRICATION**—Monel is easily stamped, readily assembled.
- **UNSURPASSED PERFORMANCE** — Read what Electric Auto-Lite Company, the oldest user of Monel rotor arms, says: *"Monel rotor arms used in our distributors have rarely been the cause of failure."* Tolerating none but the best material for each specific part, Electric Auto-Lite has long standardized on Monel rotor arms. Other important manufacturers also specify Monel.
- **REDUCES CUSTOMER COMPLAINTS** and dealers' dissatisfaction by providing long-lasting, trouble-free service.

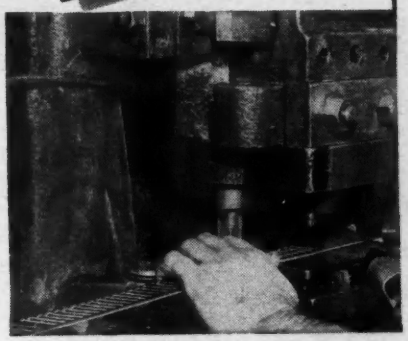
Monel and the other INCO Nickel Alloys are readily available for use in application to many other automotive ignition system accessories and parts. An INCO Nickel Alloy may help you save labor, and improve your products or equipment with surprising economy.

Send us details of your metal problems. We'll be glad to work out all the information you want on any specific application. *Reg. U. S. Pat. Off.

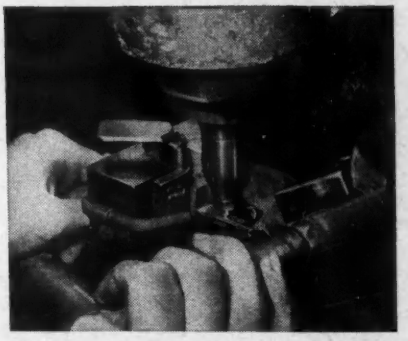
THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N. Y.

NICKEL (INCO TRADE MARK) **ALLOYS**

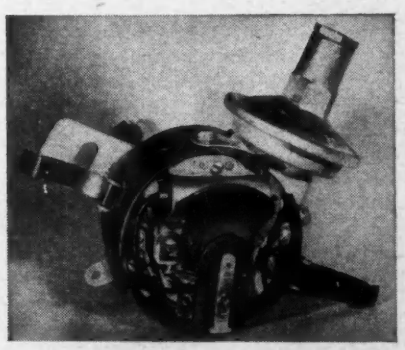
MONEL* · "K"*MONEL · "S"*MONEL · INCONEL* · "R"*MONEL
"KR"*MONEL · NICKEL · "L"*NICKEL · "Z"*NICKEL



MONEL IS EASILY STAMPED
Monel parts can be stamped out as rapidly as copper alloys or common steel alloys.



MONEL IS READILY ASSEMBLED
This is the spinning process used by Electric Auto-Lite Company to rivet Monel rotor arms securely into distributor assemblies.



MONEL KEEPS CUSTOMERS HAPPY
For every mile a 6-cylinder car travels, its rotor arm must withstand the wearing action of brush contacts and 9,000 sparks. Abrasion and spark erosion resistant, able to stand up under the corrosives common to distributor service, Monel assures lasting, trouble-free performance.

PERSONALS

Recent Personnel Changes and Appointments at the Plants of Automotive and Aviation Manufacturers and Their Suppliers.

Kaiser-Frazer Corp.—**Norris Nash,** made Manager of Sales Promotion.

Chevrolet Motor Div., General Motors Corp.—**Walter E. Schmidt,** Resident Engineer at new Chevrolet-Flint assembly plant.

Chrysler Corp.—Retirement of Vice-President and Director, **W. Ledyard Mitchell,** has been announced.

Ford Motor Co.—**William T. Gossett,** Vice-President and General Counsel, has been named a Director.

Ford Motor Co.—**Edwin Charles Simons,** Manager, Ford's new Government Sales Section, with headquarters in Washington, D. C.

Northrop Aircraft, Inc.—**Richard W. Millar,** appointed Chairman of the Board of Directors. **Claude N. Monson,** General Manager and **B. G. Reed,** Asst. General Manager. **Gage H. Irving,** Vice-Pres. and Director of Northrop, has been named President and General Manager of Salsbury Motors, Inc., Northrop subsidiary.

Curtiss-Wright Corp.—**Raymond L. Ward,** Asst. Treasurer and Asst. Controller.

United Aircraft Products, Inc.—**Frederick W. Holler,** elected President.

Aircraft Industries Association of America, Inc.—**D. R. Shoults,** Vice-Pres. in charge of Engineering, Bell Aircraft Corp., has been elected National Chairman of Technical Committee; **Monroe R. Brown,** named Secretary of Helicopter Council.

White Engineering & Mfg. Co.—Appointment of **H. C. Corwin** as Sales Manager.

New Departure Div., General Motors Corp.—**Milton L. Gearing** has been made General Manager succeeding **F. G. Hughes,** retired.

AC Spark Plug Div., General Motors Corp.—**Albert B. Gomory,** retired after 36 years' service.

Perfect Circle Corp.—**J. C. Thompson,** Chief Process Engineer at Hagerstown, Indiana, plant.

Westinghouse Electric Corp.—**J. H. Jewell,** Manager of Apparatus Sales, with headquarters in Pittsburgh. **William B. Anderson,** Manager of Aviation Gas Turbine Div. Election of **Ivan F. Baker,** Vice-President of Westinghouse International Co., has been announced. Mr. Baker is also Treasurer and a Director of the Company.

Bendix Aviation Corp., Radio Div.—**R. L. Daniel,** Manager of Aviation Radio Sales.

Bendix Aviation Corp., Bendix Products Div.—**J. A. MacLean,** Supervisor of Quality.

Clark Equipment Co.—**L. A. Bixby** and **E. M. Schultheis,** elected Vice-Presidents.

Detroit Tube and Steel Co.—**C. T. Goodwill,** Manager of Sales Strip Div. and **D. A. Nabb,** Manager, Sales Tube Div.

Metal Carbides Corp.—**R. M. Lindgren,** and **Paul E. Dimling,** appointed Sales Engineers.

Koppers Co., Inc.—**Brig. Gen. Hugh C. Minton,** Production Manager.

Houdry Process Corp.—**Dr. Claude C. Peavy,** Chief Engineer.

Cutter Laboratories—**Gordon Monfort,** Advertising Mgr.

Threadwell Tap & Die Co.—**Carl J. Linxweiler,** Sales Manager.

United States Rubber Co., Fisk Tires Div.—**A. N. Guy,** Asst. Sales Mgr.

American Brake Shoe Co.—**Homer Parsons,** Director of Exports; **Kempton Dunn,** elected Secretary.

Plomb Tool Co.—**R. W. Kerr,** made Executive Vice-President, **H. C. Baumgartner,** Secretary and Treasurer.

Henry Disston & Sons, Inc.—**Jacob S. Disston, Jr.,** elected President, succeeding **S. Horace Disston,** who has become Chairman of the Board.

Stewart-Warner Corp.—**Thomas H. Beacom,** elected a new director.

The Carborundum Co.—**Clarence E. Hawke,** Director of Domestic Sales; **Edwin B. Forse,** Manager of Refractories Div. at Perth Amboy, N. J.; **B. H. Johnson,** Manager Refractories Sales, Perth Amboy, and **Russell G. Albertson,** Div. Manager Canadian Carborundum Co., Ltd.

Arma Corp.—**Herbert C. Guterman,** elected President, succeeding **Arthur P. Davis,** who is a Director and Engineering Consultant.

Cummins Engine Co., Inc.—**C. L. Cummins,** elected Chairman of the Board of Directors, and **J. I. Miller,** elected President.

General News

(*Continued from page* 23)

Zinc

Producers report that only Regular High Grade zinc is in abundant supply, while Prime Western and Special High Grade is confined to consumer supply. The end of the Premium Price Plan on June 30 is expected to force out smaller producers, some of whom have been getting as high as a 5½¢ subsidy. Zinc prices may go up if the new subsidy bill now being considered by Congress does not go through.

Aluminum

There is continuing improvement in the aluminum fabricated product delivery situation, with a six week backlog reported by major producers for extrusions and tubing and wire rod and bar.

Lead

A tight lead supply may be alleviated by a June shutdown among fabricators and a high rate of production from March to May. This coupled with an anticipated decrease in metal requirements is expected to balance supply and demand. The Far West labor supply is not adequate to permit further expanded production. The lead stockpile of the Metals Reserve at May 1 was reported to be 25,000 tons with lead distribution by the Government of about 5000 tons a month.

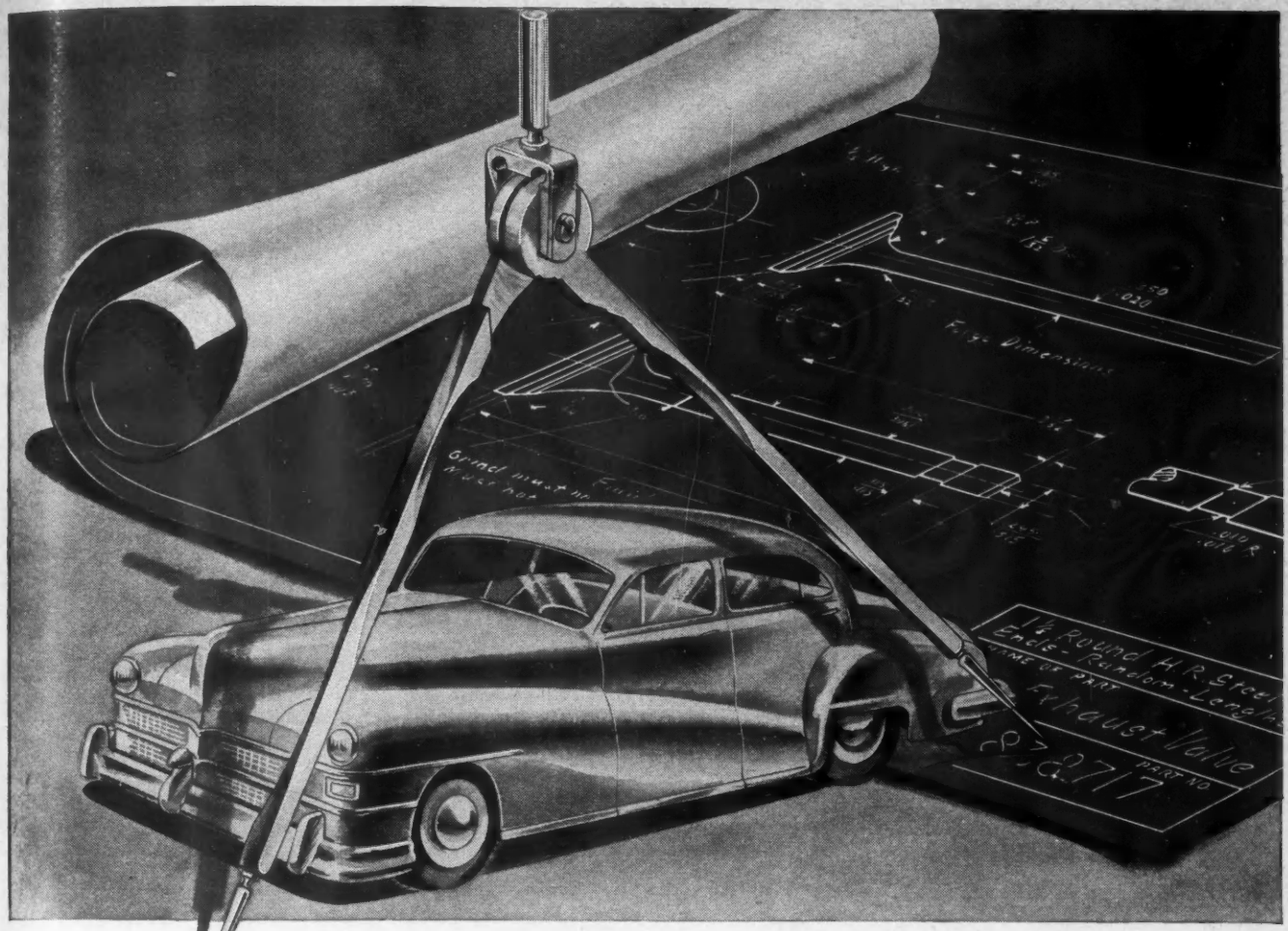
Iron Powder

Now available is a new Swedish high quality hydrogen-annealed, sponge iron powder, combining low cost with high metallic iron content and low content of oxygen, carbon and silica, which is being produced by Hoganas-Billesholms, Sweden. Particularly suited for all powder metallurgical uses except bearings, the new iron powder is said to have a higher degree of purity than any previously made.

Low-Cost Peoples' Car For and By Australians

The Peoples' Car (Australia) Ltd., with a nominal capital of $6,500,000 has been registered in Melbourne. Proposing to make a low-priced automobile for the Australian market, the new company's capital has been subscribed entirely by Australians. Production practicability has been established, and the Australian-produced engines have been road tested between 40,000 and 50,000 miles.

(*Turn to page* 70, *please*)



ALL THE GOOD NEWS COMES FROM PRODUCTION EFFICIENCY

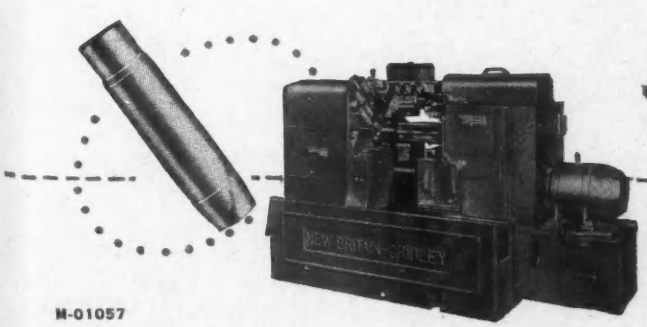
PAYING for higher wages and maintaining profits by raising prices is a sure formula for stagnation.

Lowering prices at the expense of wages or earnings on investors' savings produces the identical result.

Lower *costs*, resulting from *greater manufacturing efficiency*, is the answer. Here is something management and labor agree on wholeheartedly. But you don't *get* it by agreeing about it.

Engineers, by designing new automatic machines, new tools, and new set-up methods, have offered the key to solving the problem. It's up to management to make these better machines and methods available. It's up to the man at the machine to use that machine for all it's worth.

EXAMPLE: Formerly a leading automotive manufacturer found it necessary to rough grind the O.D. of this valve stem guide, machine the I.D. and then finish grind the O.D. Today the outside diameter is finish ground before being magazine fed into a Model 60 New Britain screw machine, which turns out over 406 pieces per hour with concentricity between inside and outside diameters well within the required .002 total indicator reading. Here is a sound saving, which, repeated in thousands of thousands of parts makes an important contribution to lowered costs.



M-01057

New Britain
Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests please be sure to give the NUMBER of the item concerning the publication desired, your name and address, company connection and title.

A-133—Shake-Out Booth—Dust Arrestor

Newcomb-Detroit Co.—A new catalog describing the Uni-Wash Shake-Out Booth has been issued by the company. It contains illustrated descriptions of the construction and operation of this new dust arrestor along with complete specifications. A full description of the Automatic Damper for use with the Uni-Wash Shake-Out Booth is also included. This device automatically directs the air to the out-of-doors when the shake-out is operating and recirculates the clean, washed air in the foundry when the shake-out is shut off.

A-134—Automatic Internal Grinder

Bryant Chucking Grinder Co.—A new four-page folder describing Bryant Series 109 Automatic Internal Grinder. A complete description, together with illustrations and specifications are included in the folder.

A-135—Rust Remover

American Chemical Paint Co.—A new folder on Deoxidine has been issued. It contains information for removing rust, cleaning and conditioning materials for painting; illustrations are included and descriptions of the various applications and qualifications of Deoxidine.

A-136—Protective Coating for Metal Surfaces

Brooklyn Varnish Mfg. Co., Inc., Industrial Research Div.—Technical Bulletin No. 101, Tuf-On-P70 Pri-Met, a new chemical prime coat for metals for maximum adhesion on brass, steel, tin, cadmium, lead, magnesium, etc. The booklet describes the process, gives specifications, including recommendations for use, surface treatment before application and application. Two short paragraphs are included giving the development and background of the product.

A-137—Cylinder Boring Machines

Ex-Cell-O Corp.—The current issue of *Tool Tips*, house organ for Ex-Cell-O Corp., features an article on cylinder boring machines for the automotive industry. It contains illustrations of various types of standard angular machines that handle straight or V-Type blocks and also a vertical style of machine for in-line blocks. The issue of *Tool Tips* is Vol. 22, No. 4.

A-138—Hydra-Matic Transmission

The Texas Co.—Vol. 33, No. 4 of the company's publication *Lubrication* is devoted entirely to an article on hydramatic transmissions. It is well illustrated with schematic drawings, sectional views of transmissions, etc. Tables on front, center and reverse planetary gears are included.

A-139—Pen-Kote 590—Rack Coating

Peninsular Chemical Products Co.—Has announced an illustrated bulletin on Pen-Kote 590, a non-inflammable, odorless Saran-base rack coating which withstands chlorinated degreasing solvents as well as all plating and cleaning solutions.

A-140—Split and Tubular Rivets

Chicago Rivet & Machine Co.—Industrial Catalog containing complete information on the use of split and tubular rivets. The various models of rivet setters are described and illustrations are accompanied by specifications for each type.

A-141—Lathes

The Monarch Machine Tool Co.—4-color, 24-page Bulletin No. 302, covering the company's Model EE Toolmak-

(*Turn to page* 64, *please*)

TIME SAVER COUPON for your convenience in obtaining, without obligation, more information on any one or more of the publications described above OR *New Production and Plant Equipment* OR *New Products items described on following pages.*

Automotive and Aviation Industries,
Chestnut & 56th Sts., Philadelphia 39, Pa.

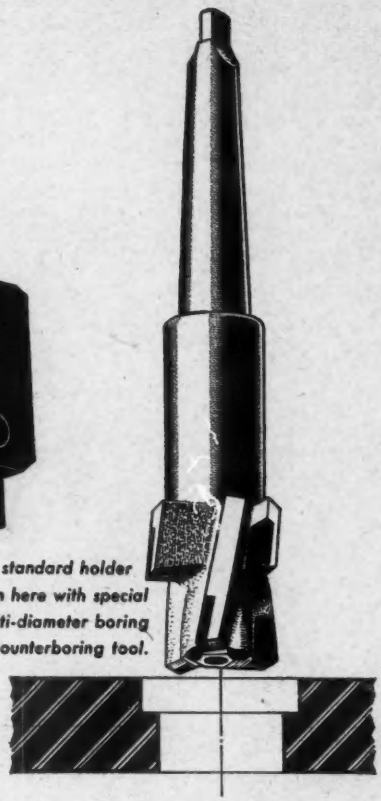
Please send me: **These FREE Publications** (Order by Number Shown on This Page)	*Please send me more information on:* **New Production and Plant Equipment** (Order by Number Shown on Following Pages)	*Please send me more information on:* **New Products** (Order by Number Shown on Following Pages)
....	....	....
....	....	....

Your Name ..... Your Title .....

Your Company Connection or Business .....

Address .....
(Street & No.) (City) (Zone) (State)

Special boring, counterboring, and facing tool.
All tools shown on this page are reduced to about 2/5.



Gairing standard holder shown here with special multi-diameter boring and counterboring tool.

Regardless of Size...

Gairing standard holder with standard ¼" counterbore and pilot, and with standard ½" countersink.

The large Facing, Boring and Counterboring tool, measuring 13½ inches in diameter by 23 inches long, is one (but by far not the largest) of those tools especially engineered and built by GAIRING to suit the specific requirements of your production jobs. We will gladly cooperate with you in working out the most advantageous application of end cutting tools to your product.

The quarter-inch interchangeable counterbore and the countersink shown at the extreme left, are among the smallest of GAIRING'S complete line of standard tools. A great number of manufacturers have standardized on them, and you too can do so at a saving. Outline your needs and we will send descriptive literature. Or, should your requirements be unusual, our Engineering Department will give your problem the benefit of their wide experience.

Regardless of size . . . GAIRING will furnish the end cutting tools to do your job economically and well.

THE GAIRING TOOL COMPANY
DETROIT 32, MICHIGAN

GAIRING TOOLS

Burwain Assembly In Norway

A large assembly plant called Nordisk Dieselauto, a subsidiary of Burmeister and Wain, is being built at Sydhavnen, Norway, for the assembly of Studebaker, Willys-Overland, and Standard cars. At first, assembly will be centered on the Studebaker chassis into which the Burwain Diesel engine will be fitted, and it is expected that ultimately 3000 cars a year will be manufactured in this plant.

Less Inspection Personnel With Production Efficiency

Automobile manufacturers report that they have been able to reduce greatly the number of employes on inspection since they began building automobiles in 1945. Many of the production problems which necessitated increasing inspection together with troubles arising from untrained and careless workmen apparently have been largely decreased or eliminated, and worker efficiency is on the upgrade.

THESE three distinguishing features have made the Aetna "T" Type Bearing a symbol of rugged endurance—have made it the trusted choice of most vehicle builders for that hard worked Clutch Release position.

- **permanent alignment of the raceways — no eccentric thrust, no chatter, no excessive wear**
- **the oil-impregnated bronze retainer—smooth, silent bronze-to-steel contact**
- **permanently sealed-in lubricant**

It helps any vehicle attain peak performance to equip it with the Aetna "T" Type Bearing.

A wise step upward is to consult with Aetna engineers—costs nothing, may well lead to vital economies.

MAKERS of
THRUST BALL BEARINGS, Standard and Special
ANGULAR CONTACT BALL BEARINGS
ROLLER BEARINGS Special,
BALL RETAINERS,
HARDENED and GROUND WASHERS

AETNA BALL & ROLLER BEARING CO.
4600 Schubert Avenue • Chicago 39, Illinois
***In Detroit:* Sam T. Keller**
7310 Woodward Avenue
Phone: Madison 8840-1-2

Aetna BALL & ROLLER BEARINGS

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE *and* AVIATION INDUSTRIES

Narrow fluctuations in general business activity are indicated. The *New York Times* index for the week ended May 10 stands at 145.9, as against 146.5 for the preceding week and 124.3 a year ago.

Sales of department stores during the week ended May 10, as reported by the Federal Reserve Board, equaled 310 per cent of the 1935-39 average, as compared with 279 per cent in the week before. Sales were 13 per cent above the corresponding distribution a year earlier, as against a preceding excess of 12 per cent. The total in 1947 so far reported is 11 per cent greater than the comparable sum in 1946.

Electric power production increased slightly in the week ended May 10. The output was 19 per cent above the corresponding amount in 1946, as compared with a like advance of 15.7 per cent shown for the preceding week.

Railway freight loadings during the same period totaled 884,242 cars, 0.2 per cent more than the figure for the week before and 29.1 per cent above the corresponding number recorded last year.

Crude oil production in the week ended May 10 averaged 5,004,600 bbl daily, 53,700 bbl more than the preceding average and 255,900 bbl above the comparable output in 1946.

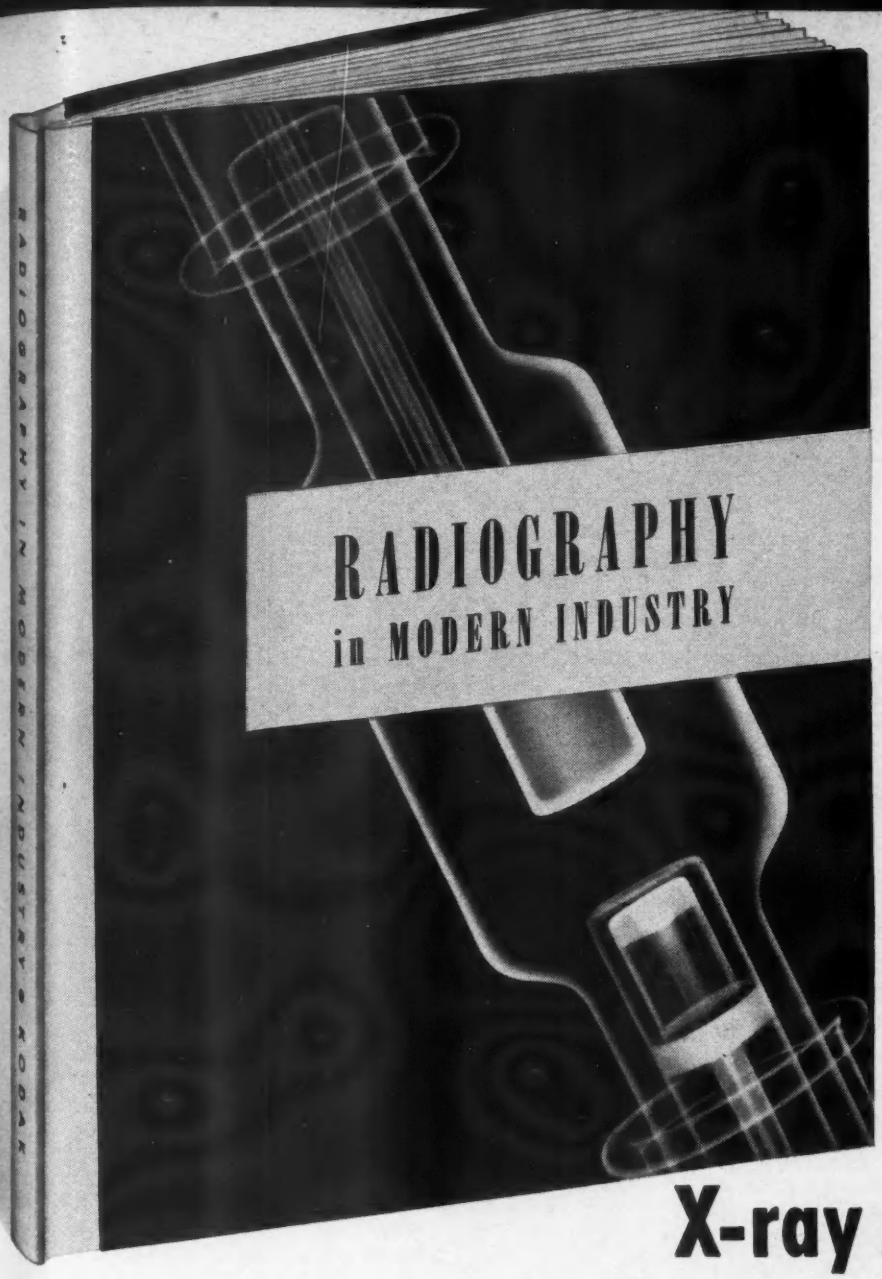
Production of bituminous coal and lignite during the week ended May 3 is estimated at 12,570,000 net tons, 2.3 per cent less than the output in the week before. The total production in 1947 so far reported is 28.7 per cent above the corresponding quantity in 1946.

Civil engineering construction volume reported for the week ended May 15, according to *Engineering News-Record*, is $13,313,000, or 38 per cent more than the preceding weekly figure but 5 per cent below the comparable sum in 1946. The total recorded for 20 weeks of this year is 4 per cent more than the corresponding amount in 1946. The increase in public construction is 15 per cent, but private construction is 3 per cent below that a year ago.

The wholesale price index of the Bureau of Labor Statistics for the week ended May 10 is unchanged at 139.6 per cent of the 1926 average, as compared with 110.1 a year ago.

Member bank reserve balances increased $72 million during the week ended May 14. Underlying changes thus reflected include an advance of $3 million in Reserve bank credit and a decline of $98 million in Treasury deposits with Federal Reserve banks, accompanied by a reduction of $63 million in money in circulation.

Total loans and investments of reporting member banks declined $231 million during the week ended May 7. A decrease of $94 million in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $10,849 million, shows a net increase of $3,393 million in 12 months.



Just off the press...

Industry's X-ray Answer Book

Metallurgists, foundrymen, welders, radiographers, designers, engineers, production and quality-control engineers . . . here's a new book you'll want to study. It's a text of modern industrial x-ray practice . . . the most complete treatment of the subject yet published. Price $3.

● Do you have questions about radiographic practice? Here's a book that will help you answer them . . . quickly, authoritatively.

It contains 122 pages of up-to-date data on such topics as radiography's function in industry; x-ray generating apparatus; factors governing exposure; the arithmetic of exposure; sensitivity and detail visibility; special technics . . . and many more subjects just as vital in radiation theory and practice.

This important new book on radiography is packed full of excellent illustrations . . . 64 descriptive photographs . . . 38 colorful drawings . . . 44 clearly presented tables and charts . . . all newly published. It will provide you with many answers . . . on where and how to use the radiographic process . . . how to get the best out of your x-ray equipment.

Only $3. Order your copy from your local x-ray dealer!

Eastman Kodak Company, Rochester 4, N. Y.

Radiography... another important function of photography

Kodak

Publications Available

(*Continued from page* 60)

er's Lathe. Design and construction features of the 10-inch sensitive precision machine are covered in the bulletin which contains a number of illustrations, including several views of the electrical and mechanical details of the equipment.

Complete specifications are listed and both standard and extra equipment are illustrated and described.

A-142—Time Cycle Controllers

The Bristol Co.—A new 12-page bulletin, No. C305, covering the company's line of Model C500 Impulse-Sequence Time Cycle Controllers has been issued. The bulletin gives detailed information about the newly developed Model C500 Cycle Controller for tire presses, plastic molds and general process operations. It is illustrated with line drawings to show principle of operation and method of use on typical plant processes.

A-143—Tube Mills

American Electric Fusion Corp.—12-page catalog on Tube Mills, machines designed for converting strip steel into electrically welded tubing. Operation and construction details of the machines are pictured and described.

A-144—Hydraulic Power Steering Systems

Vickers-Inc. 18-page bulletin describing the hydraulic power steering system. Typical applications are pictured and described and installation and specification data are given. A schematic drawing of the steering booster operation is included.

A-145—Roller Chain Engine Drives

Diamond Chain Co., Inc.—A 12-page booklet describing roller chain engine drives, including a series of examples of timing, pump, generator, blower exciter and other auxiliary drives has been released by the company. Installation views and schematic drawings illustrate these engine applications. Title of the booklet is Diamond Diesel Drive Dozen.

Broaching Standards for Interchangeability

The Broaching Tool Institute has completed an extensive survey among its members regarding the use of broaching equipment which has resulted in the adoption of standards on a method of dimensioning screw holes and washers for broach inserts and holders and in the adoption of a standard keyway chart. The purpose of these standards is to provide tool engineers with a uniform set of specifications with which each of the broaching equipment manufacturers is familiar so that interchangeability of tooling will be possible.

Small, Husky Tire For Skystreak

B. F. Goodrich engineers have developed a new tire which solves a problem of limited space for wheel retraction on the Skystreak, the Navy's supersonic research plane developed by Douglas. Strength and small size are accomplished by using an eight ply carcass construction reinforced with nylon cord and a 4.4 in. cross-section, a 20 in. over-all diameter with an extremely high air pressure of 175 psi. A take-off load of 9,750 lb can be supported by two of these tires.

SOUTH BEND TURRET LATHES

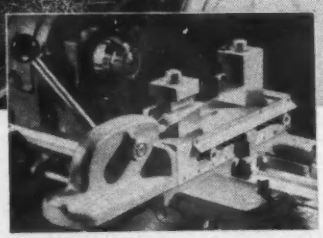
CUT COSTS ON 2nd OPERATIONS

If your problem is close-tolerance, second operation work, check up on South Bend Precision Turret Lathes. They are specifically designed for the volume production of small, accurate parts. The turret head indexes within plus or minus .0005", measured 4" from the turret face. Ample speed, power, and rigidity permit maximum tool efficiency. They are fast and easy to operate. Moving parts have no excess weight to slow down handling and cause fatigue.

South Bend Precision Turret Lathes are made with ½" and 1" maximum collet capacities. Prices start at $714.00, f. o. b. factory, less electrical equipment.

WRITE FOR CATALOG 100-F—it also describes Precision Toolroom and Quick Change Gear Lathes with 9" to 16" swings.

Series 1000 South Bend Precision Turret Lathe in the Republic Aviation Corp. plant.



DOUBLE TOOL CROSS SLIDE with hand-lever or power feeds, front and back tool blocks, and adjustable stops.

BUILDING BETTER LATHES SINCE 1906

SOUTH BEND LATHE WORKS

512 EAST MADISON STREET • • SOUTH BEND 22, INDIANA

"1,000,000 VOLTS TO TAKE THIS PICTURE"

CWC

Campbell, Wyant and Cannon Foundries

MUSKEGON, MICHIGAN Henry Street Plant, Sanford Street Plant, Broadway Plant

SOUTH HAVEN, MICHIGAN National Motor Castings Div.

LANSING, MICHIGAN Centrifugal Fusing Co.

IT IS A RADIOGRAPH of a casting . . . taken by a million volt X-ray. Metallurgical research at C.W.C., aided by X-ray, has led to many advancements in the improvement of castings. This "eye" that looks into the casting is an extremely important factor in the development of alloyed metals. Because of scientific inspection and control measures, the castings of the Campbell, Wyant and Cannon foundries are consistently of the highest quality.

CAMPBELL, WYANT AND CANNON FOUNDRY COMPANY

MUSKEGON, MICHIGAN

"Drive Faster... set up solid, without burrs" says EVINRUDE

NO WOBBLY STARTS *and slow driving to avoid skids here. Phillips Screws go in fast, set up tight and flush to hold cover of water jacket.*

DRIVING TIME CUT 30% *in fastening base plate to muffler assembly with Phillips Screws. Power driver centers and stays in recess—no slips.* ▶

... Key points of another study of assembly savings made with Phillips Screws in leading plants; from report of James O. Peck Co. independent investigator.

TIGHT FASTENING *is essential in joining the two parts of die cast fuel tank, so Evinrude depends on Phillips Screws. Photo shows use of Phillips Screws for attaching nameplate where skids would mean expensive refinishing.*

"Obvious assembly savings prompted our use of Phillips Head Screws in the 'Zephyr' Outboard Motor," explained Evinrude's Works Manager, "and results are even better than expected."

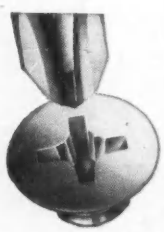
"Phillips Screws make the most of power tool speed. No lost motion as when driving slotted screws. We just bring the driver bit down and it automatically centers and seats in the Phillips Recess. That makes for a very fast operation... and an economical assembly. Also, we avoid driver skids, and subsequent expensive refinishing.

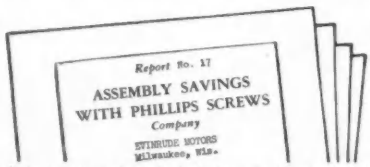
★ ★ ★

"We have to set 'em up solid, and the Phillips Recessed Head can take the necessary torque without breaking or burring. Outboards often get rough usage, and Phillips Screw fastenings match the sturdiness of the overall construction.

"Dangerous burrs avoided. Workmen can get bad cuts on hands and arms from sharp burrs common to slotted screws. With Phillips Screws, that hazard is banished, and the burr-free, ornamental recess has a much more shipshape appearance.

You'll find good ideas for your assembly operations in the complete report of this and other assembly studies... on metal, wood, and plastic products. Inside facts on modern methods of America's best assembly engineers. FREE—use coupon.





Phillips Screw Mfrs., c/o Horton-Noyes
1800 Industrial Trust Bldg.,
Providence, R. I. 12

Send me reports on Assembly Savings with Phillips Screws.

Name .....

Company .....

Address .....

PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

23 SOURCES

American Screw Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wolverine Bolt Company

New Products

(*Continued from page* 50)

sure; the balanced construction produces equal pressure on both sides of the piston. The pistons are light in weight, permitting high speed operation and rapid reversals, particularly in the electric operated models. Rapid response also results from the full pipe size of parts and internal air passages, permitting unrestricted air flow.

C-71—Speed Selector

A new improved Variable-V-Planetary infinite ratio speed selector, designed as an independently mounted transmission, is jointly announced by Speed Selector, Inc., Cleveland, Ohio, and The B. F. Goodrich Co., Akron, Ohio.

The Speed Selector employs planetary motion with four variable pitch sheaves and two standard cross section V-belts to provide any speed from zero to 800 rpm at constant torque, from a constant speed power source.

The new Speed Selector models are available for ½, 1 and 2 hp output. Optional V-belt or flexible coupling input and output make the Speed Selector adaptable for mounting in any position.

C-72—Tubeless Tires

Tubeless tires have been developed by the B. F. Goodrich Co., Akron, Ohio, and are now undergoing tests, according to a company announcement. The rayon-cord casing is lined with a soft, sticky rubber sealant, and careful fitting of the bead to the rim guards against loss of air at this point.

The new tire is said to combine the safety features of puncture-sealing inner tubes with improved riding qualities, high bruise resistance, and remarkable ability to retain air. It will be offered only for limited sale at the present time.

C-73—Nailable Steel Flooring

A nailable steel flooring designed to cut maintenance costs for trucks and trailers is a recent development of the Great Lakes Steel Corp., a unit of National Steel Corp.

The new floor consists of steel channels between which ordinary nails may be driven. Nails driven into grooves formed by parallel flanges of curved steel are deformed and held more securely than when driven into wood. Thus the equipment can handle freight customarily secured by blocks nailed in place to wooden floors.

The 8-in. wide channels are formed from N-A-X High Tensile, a low-alloy high-strength steel noted for resistance to abrasion and corrosion. The channels are laid across the width of the truck and welded to the underframes, with a space left between the channels to provide the nailing groove. The grooves are filled with a self-sealing composition which prevents loss of bulk freight, such as sand and grain.

Bendix Builds B-36 Wheels and Brakes

The contract to supply wheels and brakes for the Consolidated Vultee's new 139-ton B-36, said to be the world's largest bomber, has been awarded to the Bendix Products Division of the Bendix Aviation Corp. The tremendous weight of the huge bomber will be supported on two trucks on four wheels each. The nose strut, built by Bendix, is equipped with Bendix dual co-rotating wheels both of which are mounted on a single axle.

BUT . . .

It passed from the American scene when metropolitan traffic grew too heavy for its one horse power. Today's streamlined model is an engineering triumph, embodying efficiency, speed and control among its many features.

CHEMICALS ACP PROCESSES

RUST PROOFING AND PAINT BONDING
Granodine *
Duridine *
Bonderite *
Lithoform *
Thermoil-Granodine *

RUST REMOVING AND PREVENTING
Deoxidine *
Peroxine *

PICKLING ACID INHIBITORS
Rodine *

Duridizing with Duridine*

the modern metal conditioner, gives you similar advantages.

Duridine cleans — removes oil, grease and other surface soil. It also phosphatizes — changes the metallic surface into a non-conductive phosphate film of uniform crystalline structure, a durable bond for organic finishes.

Utilizing power spray washers of mild steel construction, and applied in a simple, fool-proof process, DURIDINE provides outstanding protection for painted sheet metal products.

* Trade Mark Reg. U. S. Pat. Off.

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

HERE'S THE NEW LINE OF Series K ROPER ROTARY PUMPS

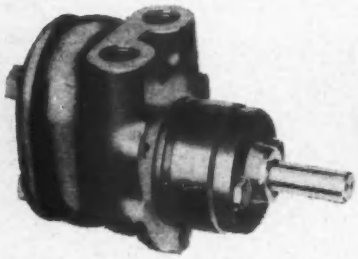


FIG. 17K PUMP HEAD with Mechanical Seal. Sizes ¾, 1½, and 3 g.p.m., as illustrated. Fig. 18K is equipped with built-in relief valve. Packed Box is available.

FIG. 1K with Packed Box. Available in 5 g. p. m. size only. Fig. 2K is equipped with built-in relief valve. Mechanical seal is available.

FIG. 1K with Packed Box — supplied in 10, 15, 20 g.p.m. sizes with companion flanges. FIG. 2K equipped with built-in relief valve. Mechanical Seal available on all models.

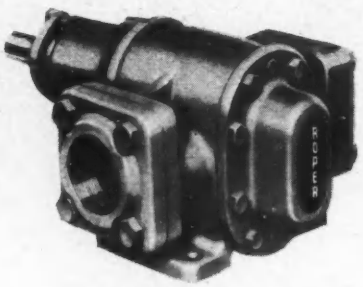


FIG. 1K with Packed Box — supplied in 30, 40, 50 g.p.m. sizes with companion flanges. FIG. 2K equipped with built-in relief valve. Mechanical Seal available on all models.

¾ TO 50 G.P.M. — PRESSURES TO 150 P.S.I.

Adaptable to a wide range of jobs . . . pressure lubrication, hydraulic service, fuel supply, or transfer work pumping clean liquids. These Ropers are self-priming, operate in either direction, handle total suction lifts up to 25 feet. Direct connected, belt, or chain driven. Because of the new Roper venturi suction and discharge principle, energy loss from cavitation, turbulence, and friction is minimized. This proportional means of distributing viscous liquids uniformly across the gear face increases operating efficiency . . . adds quietness and reduces power costs . . . permits gears to handle a wide range of viscous liquids at standard motor speeds.

Get All Of The Facts— Send For Booklet

Complete Model "K" details including specifications, exploded view of construction features, wide range of mountings, etc. Also describes other models up to 300 G.P.M., pressures up to 1000 P.S.I.

GEO. D. ROPER CORPORATION
606 Blackhawk Park Ave., Rockford, Ill.

PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS

ROPER Rotary Pumps

BUILDERS OF PUMPS FOR MANUFACTURING, MARINE, PETROLEUM, AND PROCESS INDUSTRIES

CALENDAR

Conventions and Meetings

Soc. of Automotive Engineers—Summer Mtg., French Lick Springs, Ind. June 1-6
The National Federation of Sales Executives, Los Angeles .....June 2-4
Amer. Soc. of Mechanical Engineers—Semi-Annual Mtg., Chicago..June 16-19
Amer. Soc. of Testing Materials—Annual Mtg., Atlantic City.....June 16-20
Amer. Soc. of Mechanical Engineers—Applied Mechanics Div., Schenectady .....June 23-25
American Electroplating Society, Detroit .....June 23-27
Institute of the Aeronautical Sciences, Annual Summer Mtg., Los Angeles, Aug. 7-8
Soc. of Automotive Engineers—West Coast Transportation & Maintenance Mtg., Los Angeles....Aug. 21-23
Natl. Air Races, Cleveland..Aug. 30-Sept. 1
Amer. Soc. of Mechanical Engineers—Fall Mtg., Salt Lake City.....Sept. 1-4
Amer. Soc. of Mechanical Engineers—Ind. Instrument & Regulators Div., Chicago .....Sept. 8-9
Instrument Society of America Conference, Chicago .....Sept. 8-12
Society of Automotive Engineers—Tractor Mtg., Milwaukee....Sept. 17-18
Natl. Machine Tool Builders Assoc. Machine Tool Show, Chicago, Sept. 17-26
Soc. Automotive Engineers, Aeronautic Mtg., Los Angeles .....Oct. 2-4
Amer. Soc. of Mechanical Engineers, Petroleum Mech. Eng. Conf., Houston, Tex. .....Oct. 6-8
Natl. Conference of Industrial Hydraulics, Chicago .....Oct. 16-17
Soc. of Automotive Engineers, Production, Cleveland .....Oct. 20-21
Amer. Soc. Tool Engineers—Semi-Annual Mtg., Boston.....Oct. 30-Nov. 1
Natl. Aircraft Show, Chicago.....Nov. 1-9
Amer. Society of Body Engineers, Annual Tech. Convention, Detroit, Nov. 5-7
Society of Automotive Engineers, Fuels & Lubricants Mtg., Tulsa.....Nov. 6-7
Society of Automotive Engineers-Air Transport Mtg., Kansas City..Dec. 1-3
Amer. Soc. of Mechanical Engineers, Annual Mtg., Atlantic City....Dec. 1-5
Automotive Service Industries Show, Chicago .....Dec. 8-13
Soc. of Automotive Engineers Annual Mtg., Detroit .....Jan. 12-16

Chrysler and GM Get OK From Housing Expediter

The Chrysler Motor Parts Corp. has been granted permission by the Office of the Housing Expediter to build a $3 million automotive parts plant at Detroit. The OHE has also approved the construction of a new $1.9 million foundry building by the Central Foundry Div., General Motors Corp. at Defiance, Ohio, for the production of gray iron castings.

Tire Manufacturers Report Trend to 15-inch Wheel

A hint from tire manufacturers indicates that practically all automobile manufacturers are showing great interest in the 15-inch wheel for future models. At least one of the Big Three is reported likely to use it on 1948 models.

FOUR FEDERATED *firsts*

THAT GIVE YOU SOLDER SATISFACTION

1 *first in* PRODUCT VARIETY

Solders for every purpose . . . rosin-core, acid-core, solid wire; pig, bar, wiping, body, ribbon, segment . . . in every commercial or special form and grade — you get them all from one source, first in the field — Federated Metals Division.

2 *first in* UNIFORMITY

Federated solders . . . made with strict lab control to meet Federated's nationally known specifications . . . are uniform in the analyses you need to produce quality workmanship.

3 *first in* TECHNICAL SERVICE

50 years' metallurgical experience, modern laboratory practice, and real solder know-how . . . interpreted by practical service engineers to keep you informed of latest developments.

4 *first in* FACILITIES

Federated has 11 strategically located plants and 25 sales offices — all the facilities that make it easy for you to deal with an organization in your own area. Deliveries are faster, and there is always a friendly Federated office within easy telephone radius.

When you buy or specify solder, be sure you get the best...with the helpful experience of the first in the field. For quality solder, and service that helps you in your work, call or write the Federated office nearest you. *Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, New York.*

JML 08 F-838

Federated **METALS DIVISION**

AMERICAN SMELTING AND REFINING COMPANY

General News

(*Continued from page* 58)

Army Jets To Roar Out of Maine

The Army Air Forces announced recently during a press review of the new jet-propelled Republic P-84 Thunderjet that the 14th Fighter Group of Air Defense Command at Dow Filed, Bangor, Me., will be the first tactical organization to receive the 600 mph craft. This group will commence operations with the fighter plane during this summer.

Successor of the famed Thunderbolt, the new P-84 Thunderjet is powered with a General Electric designed, Allison built, TG-180 axial-flow jet engine capable of developing 4000 lb of thrust. It holds the American speed record of 611 mph and, with a range in excess of 1000 miles, is considered by the Army to be the fastest and longest-range service-type jet fighter in the world.

Mundy I. Peele, president of Republic Aviation Corp., stated that the Army had contracted for more than 400 Thunderjets, and that they were now coming off the production line at the rate of one per day. It was also announced at this conference that Republic has built approximately 800 SeaBees, a four-place amphibian personal-plane, and that these planes were being produced at the rate of 10 to 12 a day.

IMPROVE ENGINE PERFORMANCE
specify
Johnson
TAPPETS
JOHNSON offers the engine industry the finest in high quality, precision tappets. . . .
● SUPERIOR DESIGN
● LIGHTWEIGHT CONSTRUCTION
● QUALITY MATERIALS
● PRECISION MANUFACTURE
● LONG-LASTING SERVICE
● KNOW-HOW OF "TAPPET SPECIALISTS" - - - MANUFACTURERS OF TAPPETS EXCLUSIVELY
Write today for new, informative JOHNSON Tappet Bulletins.
Johnson PRODUCTS INC.
MUSKEGON, MICHIGAN
"Tappets Are Our Business"

Chrysler Gets OK From OHE for $3 Million Plant

The Office of the Housing Expediter has approved Chrysler Corp.'s $3 million plant construction near Newark, Del. Covering 650,000 sq ft, the new plant will make assemblies and small parts, and will handle distribution throughout the East.

Merry-Go-Round Speeds Steering Gear Output

Merry-go-round installations appear to be catching on more and more in the automotive industry as a means of providing speedier and more efficient production. Ford Motor Co. recently installed a miniature merry-go-round in the steering gear department to replace the old inconvenient method under which steering gears were assembled by workers who passed them from hand to hand. A turntable revolves and the men standing around it perform the various operations without handling the gear. The improvement is said to have raised the potential capacity to 600 an hour, an increase of 100 per cent over the old method.

Ford Matches Union Demands With Long List of Its Own

In negotiations with the UAW-CIO, Ford Motor Co. gave union representatives a dose of their own medicine. It has been all too common for unions to go into negotiations with a yard-long list of demands for bargaining purposes, while the employer had relatively few demands to make. However, Ford is said to have compiled a long list of proposed changes covering several pages, undoubtedly some of which it does not expect to get, but which it can use to cancel out certain union demands. Included in the Ford proposals are demands that the union pay its own stewards while on union business, that seven-day operations include a swing shift, and that the number of union committeemen be reduced.

Strike Delays Completion Of Needed Steel Mill

The building trades' strike which started in Detroit on May 1 has had an adverse effect in delaying full production in the automotive industry. The strike halted work on a large

(*Turn to page* 74, *please*)

prolific perfectionist

The Bryant No. 109 Internal Grinder produces rapidly, automatically and in volume such parts as ball bearing races, gears, rolls and bushings with bore sizes up to 3". It *automatically* rough grinds, trues the wheel, finish grinds and stops when finish size is reached. Bore size is also controlled *automatically* by the wheel trueing diamond or by a plug gaging unit operating through the work spindle. Thus the operator need only load the work, trip the cycle lever and then unload the finished part — often operating two machines with little effort.

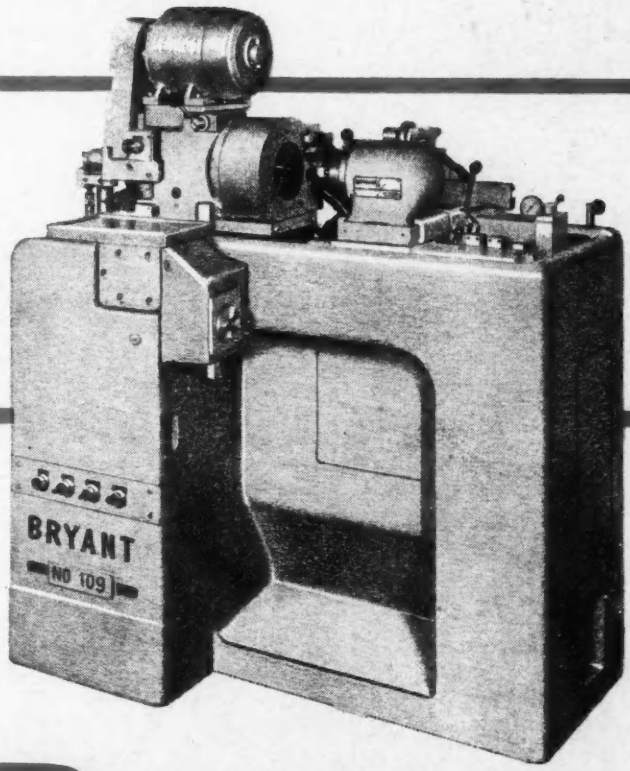
Exclusive Bryant set-up features include split-second cycle control of the wheel-slide through four adjusting throttles. Timing devices for "spark out" are provided for both rough and finish grinding. Hydraulic motors give infinitely variable work speeds and cross feeds. Preloaded ball bearing sealed slides for longitudinal and cross motions give super-smooth control of work and wheel. For proper cutting characteristics on extremely small bores, the Bryant Hi-Frequency Wheelhead offers speeds up to 100,000 r.p.m. Belt-driven spindles are used for the larger range of bore sizes.

The No. 109 is a high production machine, yet grinds bores to the finest tolerances and with work finishes of unbelievable accuracy. For details on this "Prolific Perfectionist," write for catalog.

NUMBER 109

Automatic

INTERNAL GRINDER

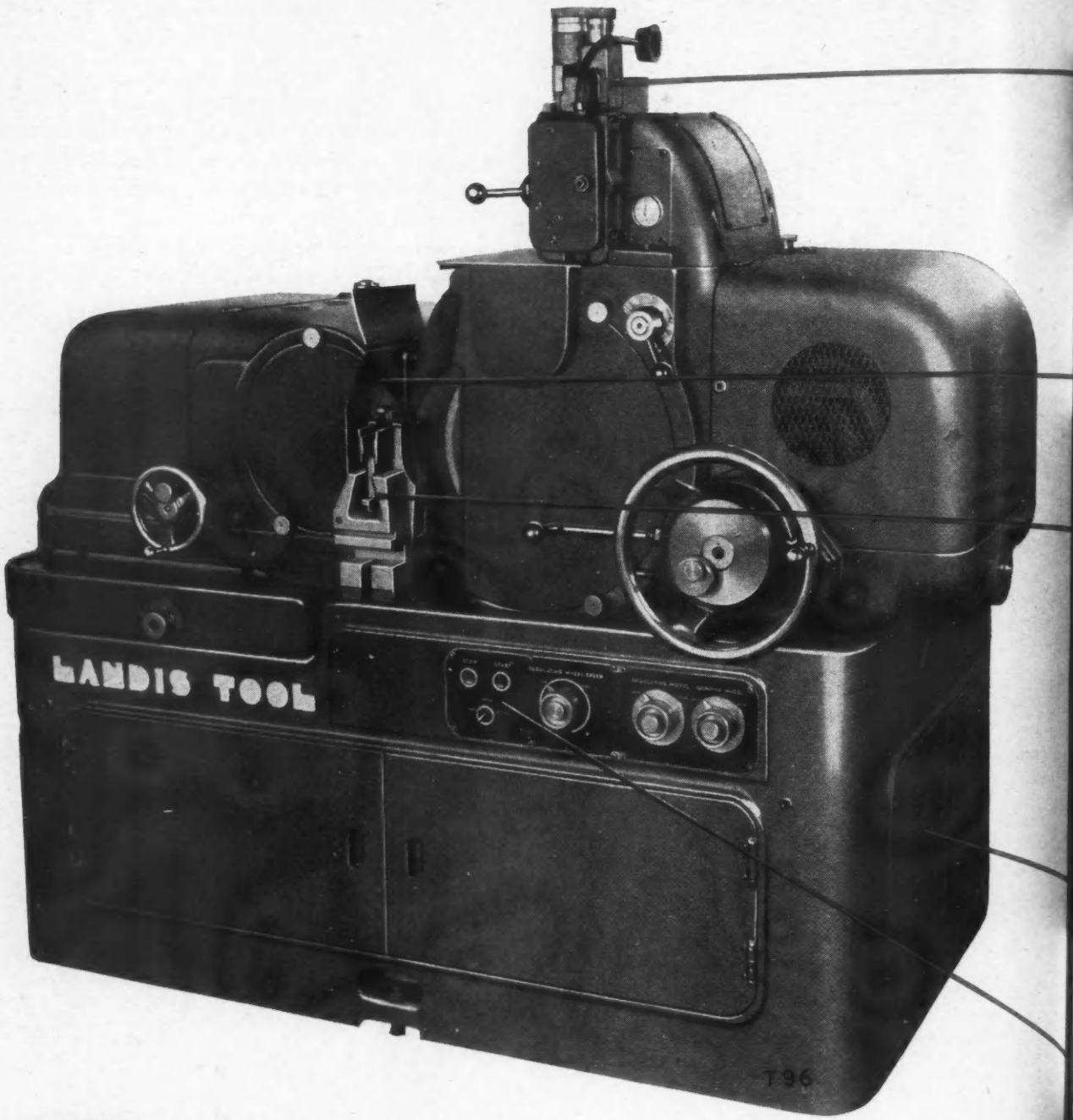


Send for the Man from

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

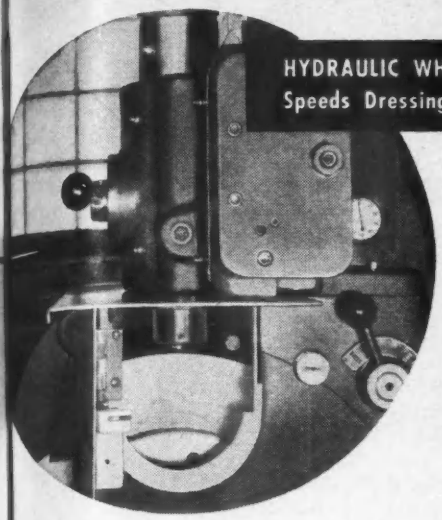
BRYANT



EQUIPPED WITH MICROSPHERE BEARINGS

LANDIS TOOL *Precision Grinders*

Request Catalog T-44 for details



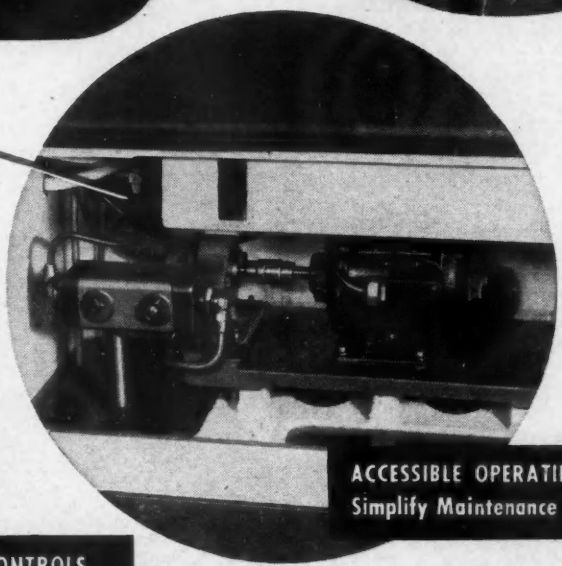
HYDRAULIC WHEEL DRESSER
Speeds Dressing

REGULATING WHEEL Dressed
Rapidly At Point Of Contact

LANDIS TOOL

Centerless Grinder Design Features for *high Production* and *easy Maintenance*

ADJUSTABLE WORK REST
Cuts Setup Time



ACCESSIBLE OPERATING PARTS
Simplify Maintenance

CENTRALIZED CONTROLS
Reduce Fatigue

61

LANDIS TOOL COMPANY, WAYNESBORO, PENNA.

General News

(*Continued from page* 70)

new mill being rushed to completion by the Great Lakes Steel Corp. Original plans called for operation of the mill by June, but delays in obtaining electrical equipment and the building strike have deferred the completion until August or September. The 500,000 ton capacity of cold rolled sheet steel which the mill eventually will provide is badly needed by Detroit automotive plants.

Timken Opens Canadian Plant

Formal opening of the new Canadian plant of the Timken Roller Bearing Co. in St. Thomas, Ontario, was made with appropriate exercises on May 23, 1947.

Auto-Lite Buys 27th Plant

The Electric Auto-Lite Co. has bought a new manufacturing plant from the War Assets Administration at Westover, N. Y. The building has 585,000 sq ft of floor space, and when placed in operation will be the 27th Auto-Lite plant in the United States and Canada.

Taylorcraft, Inc., Succeeds Taylorcraft Aviation Corp.

Successor to Tavlorcraft Aviation Corp., whose assets were disposed of in a bankruptcy sale in March, is a new company, Taylorcraft, Inc., formed at Alliance, O. A new group, headed by C. G. Taylor, original founder of the Taylorcraft firm, and Ben Mauro, a plane distributor, purchased the Taylorcraft trade name, jigs, dies, and certain parts and materials at the bankruptcy sale. Armour & Co. acquired the plant, part of which will be leased to the new organization. Capitalization of Taylorcraft, Inc., is $300,000, provided by former company officers, distributors, and dealers.

Settlements for Some Parts Companies Under 15c

Scattered reports continue to appear telling of settlements in the automotive parts industry for less than the so-called 15-cent-an-hour pattern. One large foundry compromised its wage demands at less than 10 cents an hour for hourly rated employes. A parts manufacturer succeeded in settling for 11½ cents with no pay for holidays. Another has settled for 10 cents an hour across the board with a reopening clause to apply if and when 60 per cent of the industry effects a change in the wage structure.

Yates American Machine Expands Radiator Div.

Yates-American Machine Co. of Beloit, Wis., is completing the expansion of its Radiator Div. which is expected to increase capacity 50 per cent. The equipment of the new building will include hydraulic presses, power shears, brakes and gas fired ovens together with auxiliary equipment.

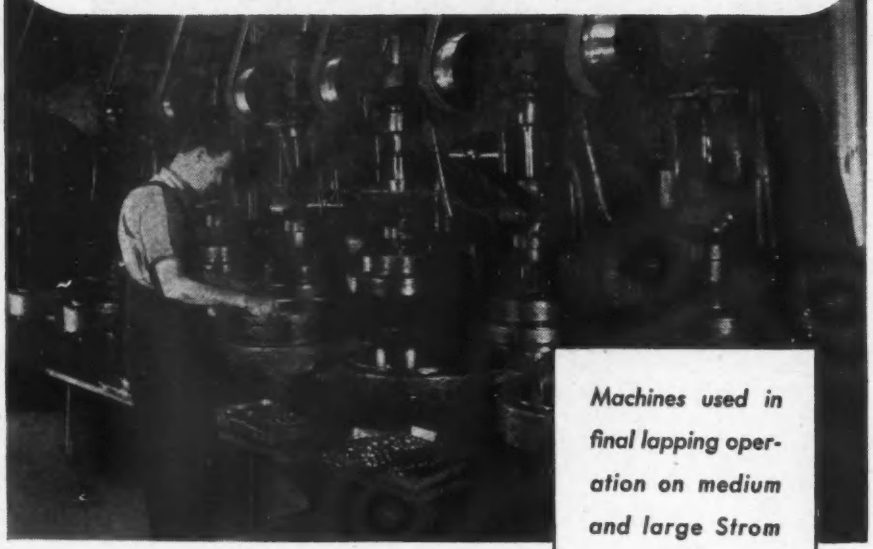
Glidden Tour for "Antiques" To Be Held in New England

The 1947 Glidden Tour of antique cars will be held September 17-23 in New England. Assembling in Hartford, Conn., on September 17, the participants—all driving cars built before 1915—will start their 500 mile trip through the six New England states, including the White Mountains in New Hampshire, on September 18. The Tour will end in Newport, R. I., on the 23rd.

(*Turn to page* 76, *please*)

Surface • Sphericity • Precision

STROM BALLS



Machines used in final lapping operation on medium and large Strom Balls.

It takes a long series of processes, developed and perfected over a period of years, to make a thing as faultless in material and form as a Strom Metal Ball. Worked to a tolerance of fifty millionths of an inch, their outstanding qualities of finish, sphericity and precision have made Strom Balls the standard of industry. Strom Steel Ball Co., 1850 South 54th Ave., Cicero 50, Illinois.

Strom BALLS Serve Industry

Largest Independent and Exclusive Metal Ball Manufacturer

Air tools by ARO

DO YOUR DRILLING FASTER!...

Got a tough production job for a ½" drill? Do it with *more speed* and *less fatigue*... with ARO Model 7016 Air Drill! It's 40% *lighter in weight* than other drills of same capacity! Big power... plenty of stamina for heavy duty, continuous production drilling, reaming and countersinking. Aro-built dependability. Switch to ARO Air Tools to save time and cut costs in drilling, grinding, screwdriving, nut-setting, other jobs. See your Aro Jobber. The Aro Equipment Corporation, Bryan, Ohio.

General News

(*Continued from page* 74)

Auto-Lite to Open 20 Field Schools in '47-'48

The Electric Auto-Lite Co. will place ten more field service schools in operation in 1947, and an additional ten will be opened in 1948. The Electric Auto-Lite field school system is an outgrowth of the original service school which was opened in Toledo in 1937 to train automotive servicemen on how best to service Auto-Lite electrical products. Field schools were opened in order that servicemen might not be required to travel too far from their home cities, and now these additional schools will give Auto-Lite excellent field training coverage.

Ford President Gets Award For Industrial Statesmanship

Henry Ford II, president of Ford Motor Co., has been named recipient of the Thomas A. Edison Centennial Memorial Award for industrial statesmanship. The plaque was awarded by the New Jersey Manufacturers' Association in cooperation with Charles Edison, son of the late inventor, in whose memory the award was established.

Trucks Record High in March

The record for commercial truck production was broken in March, according to the Civilian Production Administration, when production hit an all-time high of 117,217, compared with 114,909 trucks produced in February. First quarter production was boosted as a result to 334,853 trucks. Automobile production hit a new postwar high in March when 302,954 passenger cars were produced compared with 263,998 in February.

Lincoln May Adopt V-8 To Replace Present '12'

There is apparently some support for the report in Detroit that Lincoln will go to a V-8 engine to replace the present V-12. The company is known to have done considerable development work on a V-8 which is said to be smaller but to have more horsepower than the present 12-cylinder power plant.

Chrysler Die Orders Hint Broad Styling Revisions

From reports in tool and die circles, Chrysler Corp. is well into its 1948 die program. One source says that the corporation has placed orders for seven different dies for turret tops, indicating rather sweeping style changes in all models.

Motorola Now Official Name

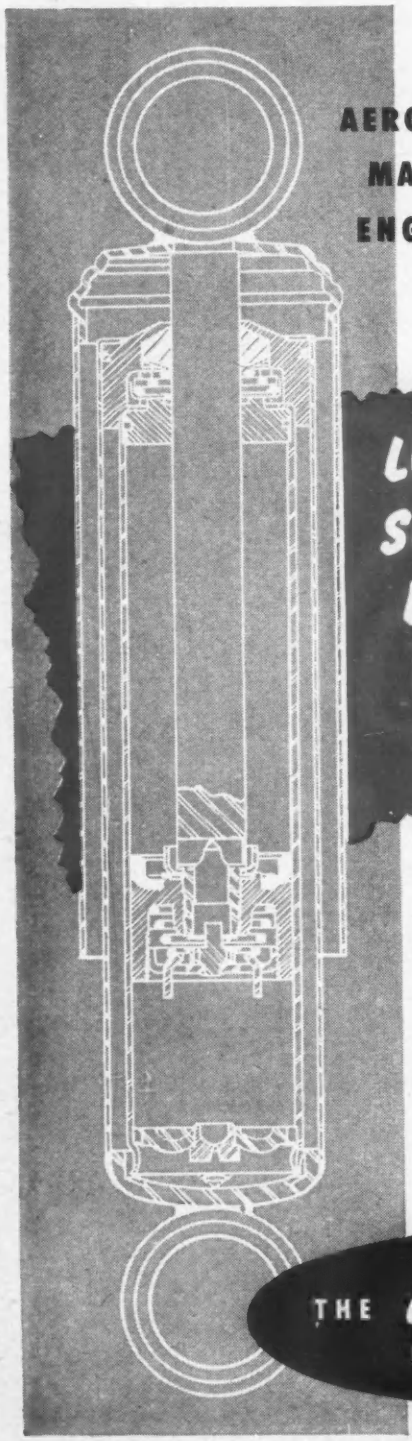
Motorola, Inc., is now the official name of the Galvin Manufacturing Corp. The corporate name was officially changed recently at a stockholders meeting because the word "Motorola" has been so closely associated with its products and service.

GM's United Motors Div. Expands in Buffalo

General Motors Corp.'s United Motors Service Div. intends to build a $400,000 parts warehouse in Buffalo. The Planning Commission of Buffalo has been petitioned for land rezoning.

Kelsey-Hayes Gets Lathan

The Kelsey-Hayes Wheel Co., Inc., has acquired as a wholly-owned subsidiary the Lathan Co., Inc., of South San Francisco, Cal., pioneers in the vacuum power brake field.



Gabriel

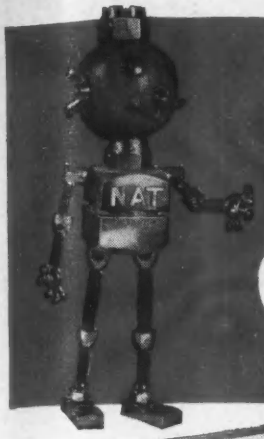
AEROTYPE SHOCK ABSORBERS MAINTAIN THE ORIGINALLY ENGINEERED RIDE CONTROL LONGER

LONGER LIFE
SEALED-IN-STEEL
NO LEAKING
NO REFILLING
NO SERVICING

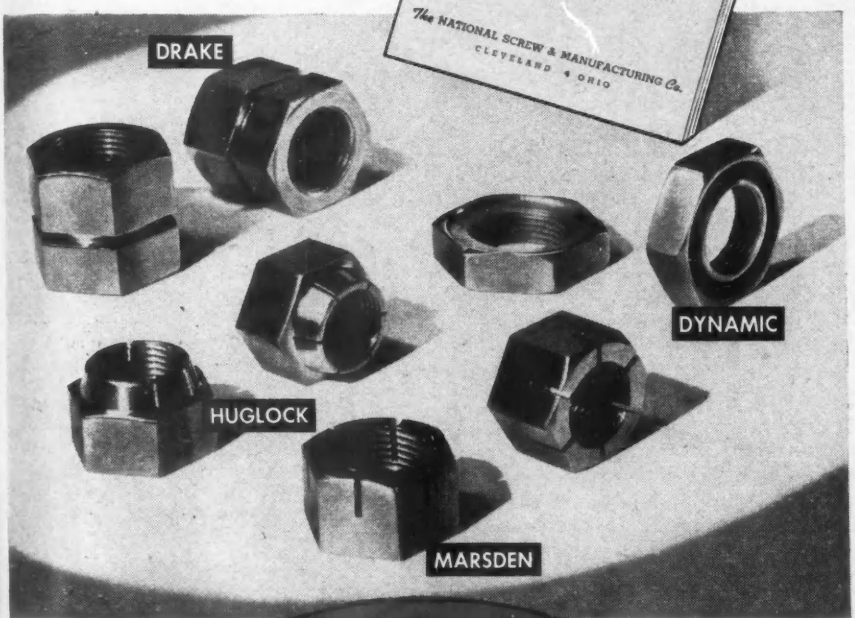
Gabriel's superior seals result in longer-lasting shock absorbers with uniform control throughout their life. A more uniform control in all temperature ranges is obtained through synthetic piston packing. And through versatile valve action, any desired control can be produced for any type of springs or suspension.

A qualified Gabriel ride engineer is as close to you as your telephone.

THE Gabriel COMPANY
CLEVELAND 6, OHIO



GET THIS *useful data* ON 4 TYPES OF LOCK NUTS



This booklet should be in the hands of every product and design engineer, and many production executives as well. It contains, in quickly usable form, data on 4 distinct types of Lock Nuts, designed to meet practically every application need.

National "Drake" Lock Nuts
Two-piece, positive lock, especially suitable for heavy-duty applications where unusually severe stress, shock or vibration is encountered.

National "Dynamic" Lock Nuts
Thin, shear nut with diaphragm lock, for applications where a thin, one-piece locking medium of light weight is necessary and where strains would be in shear only.

National "Huglock" Nuts
One-piece, all-metal lock nuts—the self-locking preset torque values are built in and insure vibrationproof results on all applications, even where high temperatures, oil or other types of moisture are involved.

National "Marsden" Lock Nuts
One-piece, cantilever action type designed for effective locking action with minimum cost. Easily applied, free running until seated.

A request on your letterhead will bring you a copy of this useful booklet, without any obligation. The National Screw & Mfg. Co., Cleveland 4, Ohio.

National
HEADED AND THREADED
PRODUCTS

OTHER "NATIONAL" SPECIALTIES INCLUDE:

Rosán Fastening System
"Lok-Thred" Studs
Place Bolts
Phillips Recessed Screws
Clutch Head Screws
Hi-Shear Rivet Pins and Collars
Davis Blind Fasteners
Laminar Flow Screws
Scrivets
Sems

THE NATIONAL SCREW & MFG. COMPANY, CLEVELAND 4, OHIO

BOOST
"Small work"
PRODUCTION
50%

Production increases to 50% are possible when you put a Ransome Model IP Motor Operated Positioner on the job for small work. Positioning gives you all the advantages of down-hand welding . . . larger electrodes . . . faster deposition . . . smoother, stronger welds. The IP is ideal for hand or automatic welding of work up to 100 lbs. in shops, industrial plants and educational laboratories . . . Work manually tilted through 135° arc and locks at any degree of tilt . . . motor rotated through 360° at variable speeds from .21 to 5 rpm. Bench mounted.

Model IH

Model IH . . . hand operated . . . helps you get more done by positioning the work for maximum accessibility. Facilitates welding, assembly, repairing, grinding and other operations.

Bulletin 210B gives complete information.

Industrial Division

Ransome
MACHINERY COMPANY
Dunellen, N. J.

Subsidiary of
WORTHINGTON
Pump and Machinery Corporation

WORK POSITIONING PAYS

V7-7

Ransome Positioners and Turning Rolls . . .
Capacities 100 Lbs. to 75 Tons

General Electric Reveals Jet Engine Specifications

Specifications of the prop-jet TG-100 and turbo-jet TG-180 aircraft gas turbines have been released, with approval of the Army Air Forces, by the Aviation Div. of the General Electric Co.

TG-100 Prop-Jet

TYPE: Axial flow compressor, multiple combustion chambers, axial flow turbine, geared propeller drive, continuous cycle.

COMPRESSOR: Fourteen stage axial flow. Steel and aluminum alloy stator casing, with 14 rows of steel compressor blades, one row of steel inlet guide vanes and one row of steel straightening vanes. Fourteen aluminum and steel rotor discs shrunk on steel shaft, each disc having one row of steel blades. Shaft supported by two sleeve bearings. Shaft spline connected to turbine rotor shaft at rear end. Compression ratio 5.5 to 1.

COMBUSTION CHAMBERS: Nine reverse-flow type, interconnected tubular combustion chambers of stainless steel. One perforated stainless steel flame tube in each combustion chamber, and one duplex fuel injection nozzle in forward end of each flame tube, with downstream injection.

TURBINE: One-stage axial flow. Fabricated stainless steel casing and diaphragm, with inserted nozzle guide vanes. Rotor disc of special alloy steel buckets welded to rim. Steel rotor shaft supported in hollow compressor rotor shaft by spline at aft end and sliding fit at forward end.

EXHAUST ASSEMBLY: Stainless steel outer cone and inner cone.

PROPELLER DRIVE: Propeller shaft driven through double planetary spur reduction gear having 11.35 to 1 ratio. Provision for No. 50 spline constant-speed propeller. Propeller shaft supported by one ball thrust bearing, and one sleeve bearing.

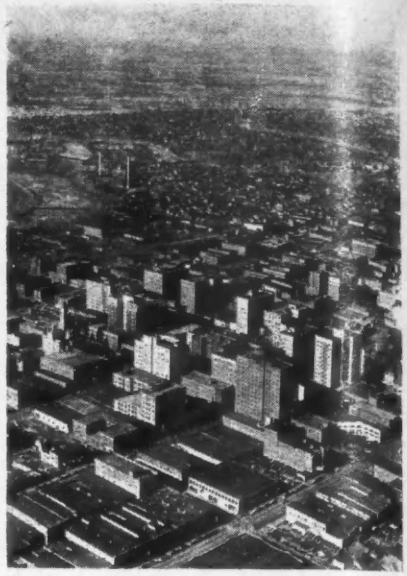
FUEL SYSTEM: Duplex common rail system supplied by multiplunger variable-displacement pump. G-E regulator with governor, altitude compensation and thermal control. G-E shutoff valve. Fuel grade JP-2 or gasoline 100/130.

LUBRICATION SYSTEM: Gear-type pump. Pressure feed and return oil system for all bearings and gearing. Oil grade 1065.

ELECTRICAL SYSTEM: G-E direct-drive starter-generator. Two ignitor plugs and two G-E 400-cycle ignition transformers. Radio-shielded harness.

DIMENSIONS: Diameter (maximum) 37.5 in., length 166 in., weight 2400 lbs.

(*Turn to page 82, please*)



10 MORE
LAYNE UNITS
FOR WICHITA, KAN.

Wichita — magic city of progress — cross roads of the western airlines — growing and prospering has just ordered ten more complete Layne high efficiency Well Water Units. This makes a total of thirty-five, with a daily production capacity of 45 million gallons of water. Here again, quality, sturdiness, and overall efficiency of Layne Well Water Systems have scored definite superiority.

Wichita long endured a dangerously low water supply, but Layne top flight hydrological engineering skill explored and found water bearing strata — and then installed modern water producing equipment.

Wichita is only one of many cities that profited by placing its water producing problem up to Layne—the world's most experienced ground water developers. Such proven skill is worthy of serious consideration by all cities, factories, railroads, refineries and irrigation projects that need more water.

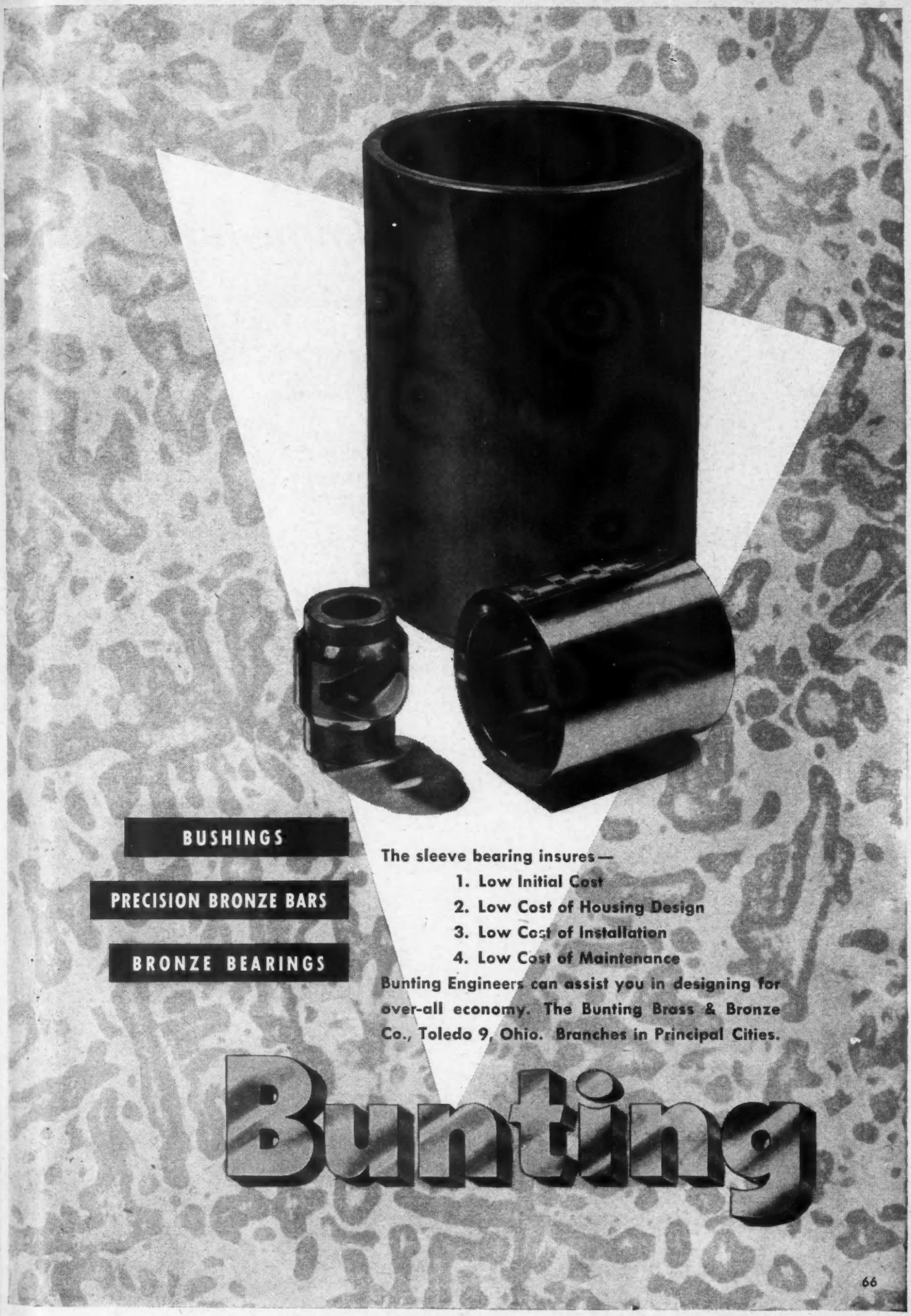
Unusually interesting and valuable bulletins, catalogs, etc., may be obtained by writing Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

PUMPS for Wells—Lakes—Rivers—Reservoirs — Irrigation Projects — are obtainable in sizes from 40 to 16,000 gallons per minute, powered by electric motor, V-belt or angle gear drives. Write for Pump Catalog.

LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Wash. ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minn., Minneapolis, Minn. ★ International Water Supply Ltd., London, Ont., Can. ★ Layne-Hispano Americana, S. A., Mexico, D. F.


BUSHINGS
PRECISION BRONZE BARS
BRONZE BEARINGS
The sleeve bearing insures—
1. Low Initial Cost
2. Low Cost of Housing Design
3. Low Cost of Installation
4. Low Cost of Maintenance
Bunting Engineers can assist you in designing for over-all economy. The Bunting Brass & Bronze Co., Toledo 9, Ohio. Branches in Principal Cities.
Bunting
66

what's your N-F I.Q.

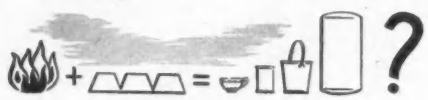
...non-ferrous know-how, that is..

Here's another Federated first . . . a batch of foundry teasers to test your mettle

1 ***Which requires the most heat to melt?***
(a) Aluminum (c) Butter
(b) Copper (d) Lead

2 ***The best atmosphere for melting brass is:***
(a) Slightly reducing
(b) Neutral
(c) Humid
(d) Slightly oxidizing

3 ***About how much water vapor is produced as a product of combustion when melting 1000 lbs. of 85/5/5/5 in a gas furnace?***
(a) 1 pt. (c) 86 gals.
(b) 1½ qts. (d) 11 gals.



4 ***The best guide to the right temperature of the metal in the furnace is:***
(a) The color of the metal
(b) A pyrometer
(c) A double-action thermostat
(d) The B.t.u. input

5 ***The most common cause of defects in copper alloy castings is:***
(a) Wet sand
(b) Dendritic structure
(c) Gas absorption
(d) Low pouring temperature

6 ***What is Di-METAL?***
(a) A 50-50 copper-tin alloy
(b) An alloy for casting caskets
(c) A brand name for certain Federated zinc base alloys
(d) A lead base alloy

7 ***What is a satisfactory method of removing slag from the tip of a pyrometer?***
(a) Hit it with a hammer
(b) Wipe it with a steel-wire brush while hot
(c) Dip it in water
(d) Sandpaper it off

8 ***When should phosphor copper be added to tin bronze melts?***
(a) With the ingot
(b) Just before casting
(c) Just as metal melts
(d) 20 minutes before pouring

9 ***Which of the following specifications indicates the alloy of composition: Cu—4%, Si—3%, Mg—0%?***
(a) F430 (c) AN-A-4
(b) QQA601 (d) S.A.E. 326

Federated **METALS DIVISION**
AMERICAN SMELTING AND REFINING COMPANY

Federated first in the non ferrous field

FMD

10 *How much silver is there in a nickel silver alloy?*

(a) 18%
(b) 0%
(c) 2%
(d) 62%

11 *What alloy of aluminum shows the best heat-treated properties?*

(a) F720
(b) F410
(c) F024
(d) F1020

12 *The best castings come from the foundry that uses:*

(a) Bathing beauty calendars
(b) Fluorescent lighting
(c) New furnace linings every week
(d) Federated ingots

"DOC TILLITY" says:

Here are the answers

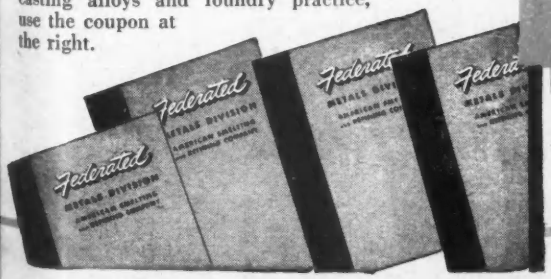
1 Aluminum, because of its high specific heat.
2 Slightly oxidizing.
3 11 gals.
4 A pyrometer.
5 Gas absorption, which leads to porosity.
6 A brand name for certain Federated zinc base alloys.
7 Wipe it with a steel-wire brush while hot.
8 Just before casting.
9 All of them, but the Federated specification number — F430 — tells you the composition at a glance.
10 0%—the name refers to color rather than composition.
11 F410.
12 Federated ingots, of course.

HOW TO RATE YOUR SCORE

Up to three wrong, you're a top-flight foundryman! Four to seven wrong, you ought to refresh your memory a bit.

If your score showed eight or more wrong, you can profitably invest some of your time chatting with a friendly Federated service man or reading Federated's helpful literature. Just call or write any of Federated's 11 plants or 25 sales offices from coast to coast or *Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, New York.*

For additional copies of this quiz, or for useful literature about non-ferrous casting alloys and foundry practice, use the coupon at the right.



FEDERATED METALS DIVISION Dept. AA JMLco-F-F1
American Smelting and Refining Company
120 Broadway, New York 5, New York

Please send me the items I have checked:

- ☐ Non-Ferrous Metals and Alloys booklet
- ☐ Aluminum Casting Alloys booklet
- ☐ Test Bars booklet
- ☐ Reprints of technical articles
- ☐ Reprint of this quiz

Company Name .....
Address .....
Signature .....

G-E Jet Engines

(*Continued from page* 78)

TG-180 Turbo-Jet

TYPE: Axial-flow compressor, multiple combustion chambers, axial-flow turbine, continuous cycle.

COMPRESSOR: Eleven-stage axial flow. Two-piece aluminum alloy stator casing with 11 rows of steel compressor blades, one row of steel inlet guide vanes, and one row of steel straightening vanes. Ten aluminum and one steel allow rotor discs shrunk on steel shaft, each disc having one row of steel blades. Shaft supported by one roller bearing and one ball thrust bearing. Shaft spline connected to turbine rotor shaft. Compression ratio 4.0 to 1.

COMBUSTION CHAMBERS: Eight direct-flow interconnected tubular combustion chambers of stainless steel. One perforated stainless steel flame tube in each combustion chamber, and one duplex fuel injection nozzle in forward end of each flame tube, with downstream injection.

TURBINE: One-stage axial flow. Fabricated stainless steel casing and diaphragm, with inserted nozzle guide vanes. Shaft and hub forging of 4340 steel welded to alloy disc, with allow steel buckets welded to rim. Hollow shaft supported in two roller bearings and compressor shaft spline.

EXHAUST ASSEMBLY: Stainless steel outer and inner cone.

FUEL SYSTEM: Duplex common rail system supplied by multiplunger variable-displacement pump. G-E regulator with altitude compensation, thermal control and governor. G-E shut-off valve. Fuel grade kerosene JP-1 or JP-2.

LUBRICATION SYSTEM: Multiplunger pressure pump and scavenge pump. Pressure feed and return oil system for front bearing and accessory gears. Oil spray with air blast cooling from 4th stage of compressor for three rear bearings. Oil grade 1065.

ELECTRICAL SYSTEM: G-E direct-drive starter. G-E generator. Two ignitor plugs and two G-E 400 cycle ignition transformers. Radio-shielded electrical harness.

DIMENSIONS: Diameter (maximum) 37 in. length, 113 in. weight (without propeller hub or generator) 1955 lb.

Have a Look!

No! Have TWO Looks!

Save *One* for the FWD Truck and its Sturdy TUTHILL Springs

The beauty of a truck is not simply its outward appearance—or any decoration upon it—but its *performance*. Back of this must be *ruggedness, strength, toughness, durability, dependability*. All these qualities must be in every part—especially the TUTHILL Leaf-Type Alloy Steel Springs. *All* are combined in the FWD, as standard, in their line of Trucks and Buses. Why not make TUTHILL *your* standard?

Tuthill makes a complete line of springs, standard or special. What are your requirements?

WE RECOMMEND TUTHILL FOR QUALITY SPRINGS

TUTHILL SPRING CO.
760 W. Polk St.
CHICAGO 7, ILL.

Quality Leaf Springs for Sixty-Seven Years

Magnaflux Machine

(*Continued from page* 52)

and one at the center for inspecting.

The cycle of events is completely automatic. As the crankshaft enters the magnetizing station, a conveyor trip switch energizes the circuit which starts the spraying of the solution and the movement of the magnetizing contact heads. As these contact heads touch the shaft, the solution is cut off automatically so that any indications are not washed off. The contact head contains two different types of magnetizing devices depending upon the nature of the inspection procedure. For longitudinal magnetization, the head is provided with a cylindrical coil which is used only in special cases, and is thrown into operation by means of an external switch. For routine inspection, magnetization is produced by means of end contacts, one head at each end of the work. The machine has two pairs of these contact magnetizers, thus permitting the automatic magnetization of shafts of two different lengths in the same cycle. The pair of magnetizers for a given shaft is selected by means of a trip switch actuated from a contact on the conveyor fixture.

The spacing of fixtures along the conveyor is such as to have a crankshaft in each station during the timed cycle. During the dwell period, the inspector checks the shaft at his station. At the same time, one shaft is being loaded; one is in the magnetizing station; one is being de-magnetized; and one at the last station is being unloaded.

Why shut down to move one machine?

DO YOU reach for red ink when machines must be moved? Do you watch production take a dive because a whole line must be shut down to tap in one machine? And do you wince at the cost of rewiring to change a shop set-up?

Then check with BullDog BUStribution DUCT for plug-in power that covers your whole plant.

Every ten-foot section of this modern electrical feeder system has ten convenient outlets. When a machine is moved the electrician need only raise the plug to the nearest outlet, snap its contact fingers over the bus bars and bolt the plug to the casing. He can do the whole job in twelve minutes or less.

A single machine, or a dozen, can be relocated with no delays for new wiring . . . no interruption of power for the rest of the line.

Built in standardized, prefabricated sections, BullDog BUStribution DUCT can be dismantled, moved and re-installed in new locations or combinations without scrapping a single bolt.

Call your nearby BullDog Field Engineer for full information on this flexible, economical power system, or write BullDog direct for descriptive folders.

ADEQUATE WIRING SERVES AND SAVES

BULLDOG
ELECTRIC PRODUCTS COMPANY

BullDog manufactures Vacu-Break Safety Switches — SafToFuse Panelboards — Superba and Rocker Type Lighting Panels — Switchboards — Circuit Master Breakers — "Lo-X" Feeder BUStribution DUCT — "Plug-in" Type BUStribution DUCT—Universal Trol-E-Duct for flexible lighting—Industrial Trol-E-Duct for portable tools, cranes, hoists.

DETROIT 32, MICHIGAN. FIELD OFFICES IN ALL PRINCIPAL CITIES. IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO.

BOOKS ...

VALVE GEAR DESIGN, by *Michael C. Turkish*, published by *Eaton Manufacturing Co., 9771 French Rd., Detroit, Mich.* This working handbook for internal combustion engine designers is the first comprehensive treatise on the designing of cams, tappets, valve springs, and other valve gear units for internal combustion engines. The author is eminently qualified to write authoritatively on this particular phase of automotive engineering. As cam design engineer and mathematician for Eaton Manufacturing Co., his experience covers automotive, aircraft, marine and industrial internal combustion engines.

Valve Gear Design is intended to be primarily a mathematical treatise covering the problems encountered in the design of valve gear mechanisms. Among its many formulae and methods are some which do not appear in any prior publication. In serving as a guide and reference for designers and engineers it can be instrumental in creating better designs.

Available direct from Eaton Manufacturing Co., cloth bound, price $6.00.

HIGH-SPEED DIESEL ENGINES (Fifth Edition, 1947). By *P. M. Heldt, formerly Engineering Editor,* AUTOMOTIVE *and* AVIATION INDUSTRIES. *Publisher, P. M. Heldt, Nyack, N. Y.*

This edition of the book is a complete revision, new material having been added particularly to the chapters on Diesel Fuels, Two-Stroke Engines, Railroad Engines, Supercharging and Cold Starting. In view of the fact the book is now being used extensively as a text in engineering classes, diagrams having a full explanation of both two-stroke and four-stroke operating cycles have been added to this latest edition, which also contains a considerable number of new illustrations, including sectional drawings of several Diesel engines brought out during the war period. A chapter on Gas Turbines has been added.

BALL AND ROLLER BEARING ENGINEERING by *Arvid Palmgren, Dr. Eng.*, translated by *Gunnar Palmgren* and *Bryce Ruley*, copyright *SKF Industries, Inc.*, published by *S. H. Burbank & Co., Inc., Philadelphia.* 270 pages of text, tables, drawings and equations.

Ball and Roller Bearing Engineering is intended to serve as a fundamental text; it is neither a comprehensive treatise nor a bearing catalog. Emphasis has been placed on fundamental principles rather than on specific problems. In order to simplify the presentation, derivations and calculations which require a knowledge of higher mathematics have been omitted wherever possible. In the section describing common bearing types, those designs which have been discussed can be considered both representative and subject to standardized manufacture. Also, the examples bearing applications presented are typical of representative designs without any pretense to cover the field completely.

Ball bearing engineering offers many different problems, some of which have not yet been completely solved. Therefore, it is not to be expected that this work should deal with all bearing problems. The author has been able to contribute to the wider dissemination of knowledge regarding modern anti-friction bearings and their proper practical utilization.

AUTOMOBILE BODY ENGINEERING AND SURFACE DEVELOPMENT—by Gustave Chutorash. 74 pages, 36 full-page plates. Pub., Chutorash, 308 Boulevard Bldg., Detroit. Credit for producing this first edition of a fundamental treatise on the development problems dealing with the surfaces of motor car bodies and sheet metal goes to the author whose fifty years of experience in the body business lends authority to his present work. We understand from specialists in the body industry that this is the first authoritative treatise of its kind, unveiling what have been considered trade secrets of the art heretofore. The text has been prepared in simple form so as to be readily grasped by student and practitioner alike. It is in the form of problems—one to a page—with the text on the left hand page and the plate on the facing page. It covers 36 unique development problems a few of which can be noted as examples—elliptics and proportional curves; increasing and reducing of objects by proportional replicator method; roof, hood, and windshield opening development; projection of horizontal and vertical section lines through roof; front fender vertical and horizontal section lines; development of side sweep and turn-under of a tonneau by conventional and replicator methods. An outstanding contribution to the art is the full disclosure of the principle and application of the "Replicator" method of analysis developed by the author and made public in this text.

WELDING ALUMINUM AND ALUMINUM ALLOYS—published by *The Reynolds Metals Co.* Reynolds Metals Bldg., Richmond 19, Va. This is the first of a series of handbooks on the fabrication of aluminum products published by Reynolds Metals Co., intended to provide engineers and production men with up-to-date data on modern manufacturing techniques. The manual on welding is profusely illustrated and contains chapters dealing with the following: gas welding; arc welding; resistance welding; spot welding, seam welding and flash welding; brazing, soldering; and an appendix covering technical data. The test discusses the metallurgy of various alloys as well as the cleaning and other preparation necessary for welding.

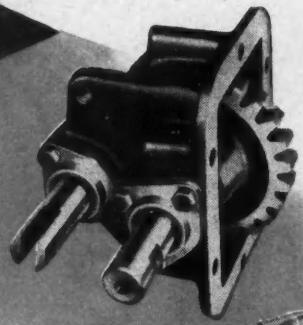
OUTSTANDING EXAMPLE of modern forging technique—an inline aircraft engine crankshaft forging—a six throw, seven bearing design having twelve integrally forged counterweights. Starting as a straight bar of alloy steel, the material is successively worked through the various forging operations to produce the ultimate shape, having flow lines carefully directed to provide greatest strength in the critical sections.
Standard of the Industry for Sixty Years
WYMAN-GORDON
Forgings of Aluminum, Magnesium, Steel
WORCESTER, MASSACHUSETTS, U. S. A.
HARVEY, ILLINOIS - DETROIT, MICHIGAN

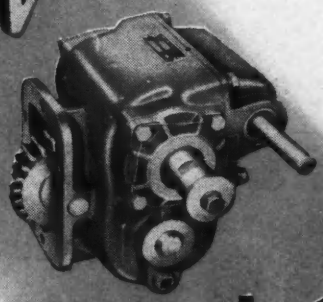
Spicer

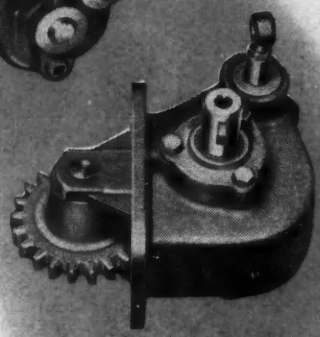
BROWN·LIPE POWER TAKE-OFFS

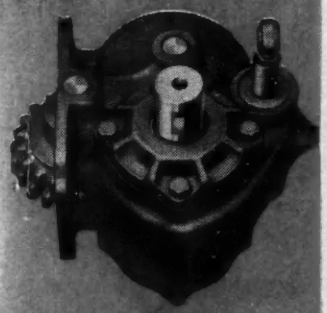
Encompass Every Automotive Need

Single Speed . . . Two Speed & Reverse
Single Speed, Two Gear for Deep Mounting
Single Speed & Reverse
Single Speed for Cable Control
Top Mounted









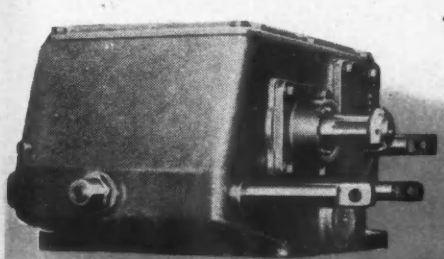
SPICER MANUFACTURING Division of Dana Corporation offers a complete line of Power Take-Offs in a range of models to meet every service requirement. These Spicer Brown-Lipe Power Take-Offs are considered standard by the automotive industry, and are more widely used than any other similar type of equipment.

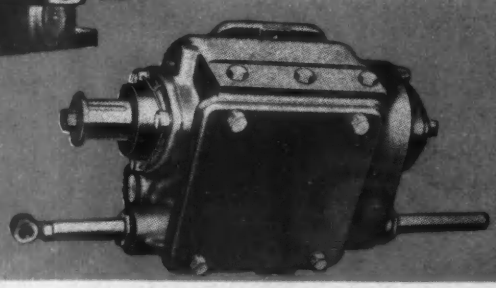
Spicer Brown-Lipe Power Take-Offs are designed to meet all operating conditions of continuous or intermittent service. All gears used are made from chrome nickel molybdenum steel forgings, annealed and case-hardened, insuring the longest possible service life under severe operating conditions.

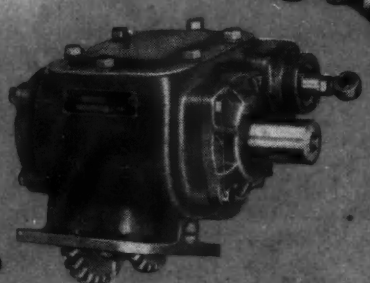
Experienced Spicer engineers will be glad to help adapt Brown-Lipe Power Take-Offs to the particular requirements of your product, wherever it may need to serve.

SPICER MANUFACTURING
Division of Dana Corporation
TOLEDO 1, OHIO

43 YEARS OF Spicer SERVICE





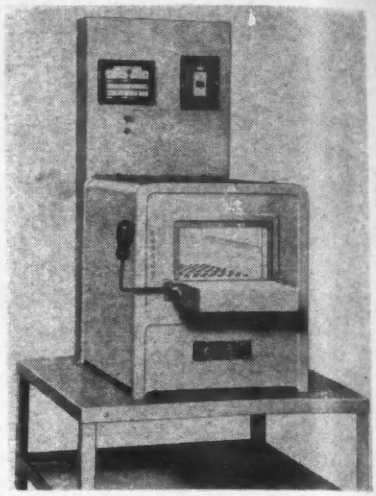


(*Continued from page* 45)

The pneumatic hammers are available in three sizes with four models in each size. These tools are adaptable for many applications, including riveting, light chipping, beading, caulking, gouging and star drilling. Offset or grip handles, Parker taper or hexagon nozzles are offered. Tapered clearance in the throttle valve seat provides accurate air metering for controlled blows.

B-47—Small Electric Box Furnaces

The Cooley Electric Manufacturing Corp., 52 S. Shelby St., Indianapolis, Ind., has added two models to its line of small electric box furnaces. The new forced circulation furnaces are available in two types—the Model ACL, for temperatures to 900 F., and the Model ACH, which is designed for operation to 1200 F. Both furnaces provide the extreme accuracy and uniformity required in all low temperature heat treating operations.

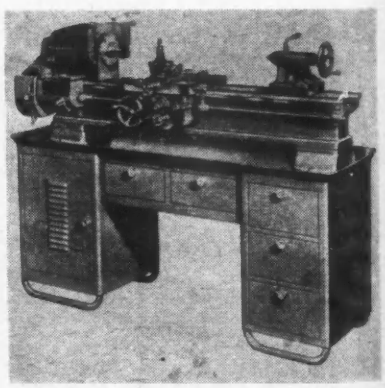


Cooley electric furnace

They may be used for tempering or drawing of both carbon and high-speed steels, non-ferrous heat treating, etc. They are said to be ideal for tool and die tempering, particularly when the tools or dies are made of high-speed steel, since furnace recovery time is rapid and the double temper of high-speed steel is easily obtained. The two furnaces are also suited to production of small parts, and for laboratory testing of paints and plastics.

B-48—Improved Sheldon Lathe

This Model TRB S-56 Sheldon lathe is now in production at the Sheldon Machine Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill. It employs "Zero Precision" tapered roller bearings in a redesigned headstock. The bed is 56 in. long and has 35 in. between centers. Swing is 11¼ in., and hole through spindle is 1⅜ in.

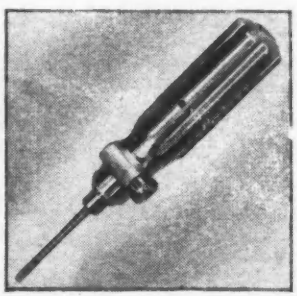


Model TRB S-56 Sheldon lathe

New Type of Torque Tools Incorporate Spring Clutch!...Are 98% Accurate!

Acme Torque Wrench and Screw Driver both incorporate spring clutches, with easily operated control. After setting control to desired torque, the operator merely turns tool in the usual way. When the torque required to drive the threaded part exceeds the pre-set value, the tool slips. Impact doesn't cause driving torque to increase. Oil doesn't affect setting which is reproducible within 2% or better.

The Wrench offers right and left-hand drive, ratchet action and withdrawal. Spring clutch may be set from 0 to 500 inch pounds. Standard sockets are interchangeable. The Screw Driver may be set for any value of torque from 0 to 35 inch pounds. A ratchet action is incorporated. The same tool will also withdraw screws. Standard bits, including socket types, may be easily inserted. The tool is made of pressure cast aluminum.



Torque Screw Driver

Another Time-Saver on the job, is chewing gum. The act of chewing aids the workers' concentration—seems to make the work go easier. Chewing gum may be used even when workers' hands are busy; reducing interruptions from the job. For these reasons many plant owners have made Wrigley's Spearmint Gum available to everyone.

You can get complete information from Acme Scientific Company, 1450 W. Randolph St., Chicago 7, Ill.

AB-64

SAVE TIME, MONEY and TOOLS

Use BONDERIZING as an aid in drawing

EIGHT IMPORTANT ADVANTAGES

Here are the advantages Bonderizing brings to drawing operations: (1) Permits use of a wider range of lubricants; (2) allows wider variation in steel composition; (3) Reduces metal to metal contact; (4) prolongs tool life; (5) permits faster drawing speeds and deeper draws; (6) reduces necessary process anneals; (7) reduces material breakage; (8) gives smoother finish to product.

The nonmetallic crystalline Bonderite* coating stretches and crushes in the drawing operation, but remains a cushion between work and tools. Bonderite's great affinity for oil holds lubricant. Result, faster drawing, fewer rejects, longer life for expensive tools and dies.

Investigate Bonderizing as an aid in drawing!

PARKER RUST PROOF COMPANY • 2178 East Milwaukee Ave., Detroit 11, Mich.

*Bonderite—Reg. U. S. Pat. Off.

SEND FOR YOUR COPY OF THIS *Valuable* BOOK

Parker technical bulletin "Bonderite As An Aid In Drawing" may help you save time, money and tools. Write today for your copy. It's FREE, of course.

BONDERIZING Holds Paint to Metal | **PARKERIZING** Inhibits Rust | **PARCO LUBRIZING** Retards Wear on Friction Surfaces

PARKER PRODUCTS CONQUER RUST

Only WARNER ELECTRIC BRAKES

Give you *all* these Time-and-Money-Saving Advantages

Engineered to meet the Specific Needs of Trailer Braking

SIMPLICITY — No other brakes equal Warner Electric Brakes for simplicity of design and construction. Full clearance under tractor and trailer. Nothing to get knocked off, leak, chatter or freeze. No exposed braking equipment . . . no rods to rattle . . . no tubes to split . . . no troublesome boosters and connections. Easy to install . . . no tapping of manifolds . . . no expensive motor work.

INSTANTANEOUS, POSITIVE ACTION—Positive-acting braking power is developed within the brake itself. Because the braking mechanism is *electrically controlled,* there is no time lag. Regardless of distances from cab to rear trailer wheels, any amount of stopping power is *instantly available.*

CONTROLLED BRAKING POWER — Driver can pre-set the "Vari-Load" dial on dash so it adjusts the electric brakes on the trailer to give correct braking to meet road and load conditions.

SYNCHRONIZED OPERATION WITH EITHER AIR OR HYDRAULIC SYSTEMS—Warner Controller synchronizes hydraulic or air brakes on tractor with Electric Brakes on trailer. Regular tractor foot pedal then operates both systems *together.*

ALL-PURPOSE CONNECTION — One rugged Electrical Cable Connection provides contacts for Brakes, Running and Parking Lights, Stop and Turn Signals—ALL electrical contacts. As easy to plug in as a radio.

UNMATCHED ECONOMY—Warner Electric Brakes are inexpensive to install due to their simplicity. Use only as much current as tail light. The most important economy factor is that they require minimum of servicing thus preventing costly delays and tie-ups of trailer equipment.

PROVED DEPENDABILITY — Warner Electric Brakes have been performance-proved by leading tractor-trailer fleet operators during many years of efficient, trouble-free service — also on thousands of military vehicles. It is noteworthy that 80% of all power-brake equipped trailing vehicles purchased by the government during World War II — had Warner equipment.

GREATER SAFETY—When both the tractor and trailer are equipped with Warner Electric Brakes their *instant* "stopping power" under *absolute control* assures greater safety. All brakes "come in" at the same time, but with various *amounts* of power. Therefore, rear trailer wheels get the effect of coming in first — and the tendency to skid or jack-knife is prevented, thus giving protection to driver and load — and avoiding costly repairs and tie-ups of equipment.

For best performance and customer satisfaction, standardize on Warner Electric Brakes for your trailers. Write for illustrated literature explaining all their advantages.

WARNER ELECTRIC BRAKE MFG. COMPANY
BELOIT, WISCONSIN

Specialists in the manufacture of Electric Trailer Brakes since 1927

The Warner Electric Brake is a simple mechanical brake, operated by an electro-magnet and armature disc. Each wheel is a complete brake unit. The braking power is generated within the brake itself. A wire to the battery and a controller complete the system — famous for its simplicity.

Just a few flexible wires from truck battery to brakes.

Sturdy cable connection from truck to trailer makes *all* electrical contacts.

"Vari-Load" dial on dash for presetting correct braking power.

Controller operates trailer's electric brakes *in unison* with truck's hydraulic or air brakes.

WARNER
ELECTRIC BRAKES

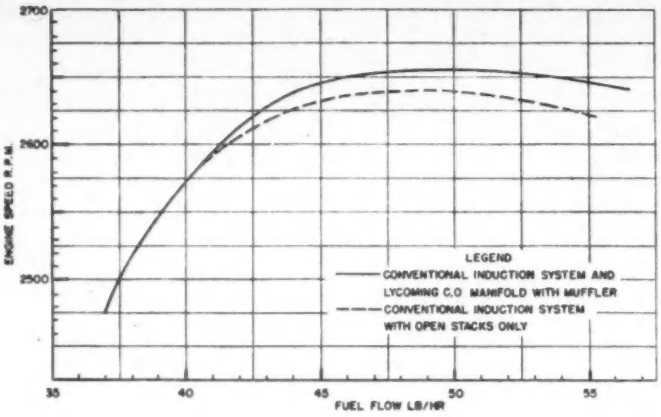


Fig. 2—Comparison of engine performance with conventional and with Lycoming cross-over exhaust systems

Aircraft Papers

(*Continued from page* 31)

manifold arrangement with a muffler consistently produced as much or more power (with smaller exhaust pipes than those previously used) as a short exhaust stack arrangement and no muffler. While such an arrangement of exhaust system does not lend itself as readily to airplane installations as do the more conventional arrangements, it does indicate what can be done. It is strongly advised that design of an exhaust system using a muffler be closely coordinated between the airplane and engine manufacturer to minimize or eliminate these engine power losses. Extensive tests of engine and exhaust system under simulated flight conditions will permit accurate evaluation which can pay off in increased airplane performance.

Power Soaring Engine

By E. H. Rowley,
Chief of Flight Test,
Boeing Airplane Co.

A sailplane power unit, that can be attached and detached as an outboard motor would be on a boat, has been developed by the author and is now undergoing experimental testing. It is a two-cylinder opposed four-stroke engine with a displacement of 43.9 cu. in., a bore of 3.1875 in., and a stroke of 2.75 in. It develops 22 hp at 4500 rpm with a compression ratio of 6.8 to 1, using 90 octane fuel. A propeller gear ratio of 2 to 1 is used. The valve arrangement is L-head which gives a reduction in engine weight and width over the overhead valve arrangement.

This engine has been installed, buried, as a pusher in a test sailplane. The cylinders are completely cowled, and individual jet pumps are used for cooling. The engine is equipped with a flywheel, and provisions were also made for a centrifugal blower to be mounted on the flywheel. A two-bladed automatic folding propeller is used. This consists of conventional wood blades and a steel hub, which houses the folding mechanism and slam-dampening cylinder. During starts and warm-ups in the air, the propeller will remain folded until a propeller shaft speed of 1000 rpm is reached. Total weight of the 54-in. propeller is 7½ lb.

The pedestal between the engine and the gear reduction unit is monocoque, fabricated from sheet dural, with provisions made for the gas tank inside. This pedestal is mounted rigidly to the engine crankcase on the lower end, and the gear box is mounted on the top end. The engine is mounted on a small tubular structure which has shock mounts at the point where the tube structure joins the airplane structure. A drive

(*Turn to page* 92, *please*)

Ready for the Finishing Touch!

. . . METAL PARTS ARE MORE EASILY FINISHED WHEN CLEANED IN A

BLAKESLEE

METAL PARTS WASHER

Write today for FREE booklet on Blakeslee Metal Parts Washers to answer your particular cleaning problems.

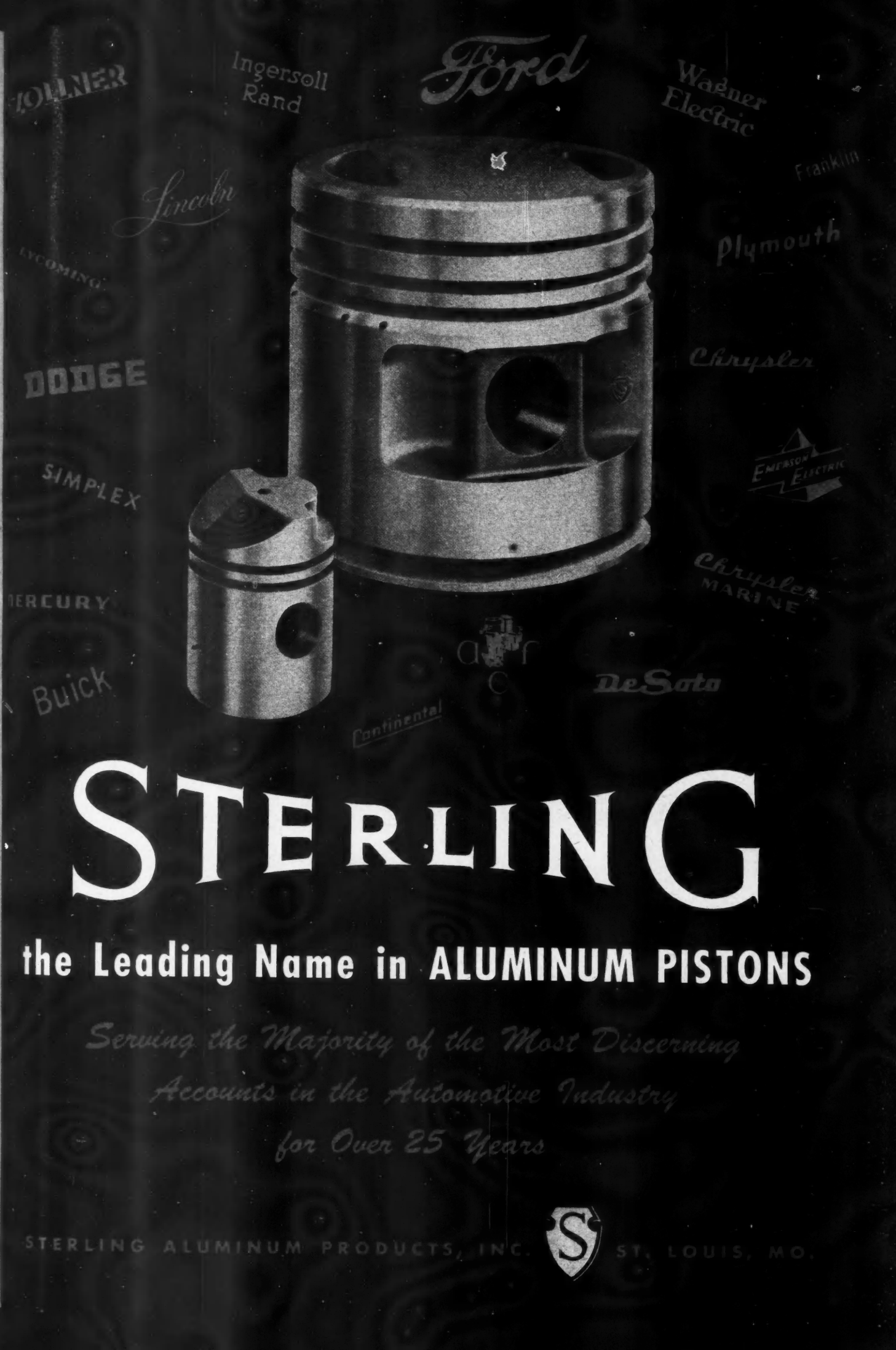
Whether the finishing operation is enameling, lacquering, machining, plating or inspecting, your washer must do a perfect cleaning job. The Blakeslee Metal Parts Washer is especially adaptable for cleaning between operations and prior to inspection . . . Continuous and batch type metal parts washers are familiar equipment throughout the automobile and aviation industries, as well as all other metal fabrication fields.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.



STERLING

the Leading Name in ALUMINUM PISTONS

Serving the Majority of the Most Discerning Accounts in the Automotive Industry for Over 25 Years

STERLING ALUMINUM PRODUCTS, INC. ST. LOUIS, MO.

Aircraft Papers

(*Continued from page* 90)

shaft with a torsional dampener connects the engine to the gear box. The cowling around the engine is so designed that it may be removed readily and contains the necessary firewall to separate the engine from the airplane structure. Upon removal of the cowling fillet combination, the engine is completely bared, and the attachment pins for the unit are accessible. These attachment pins are four in number, and other than these, the only necessary connection to the airplan is throttle and starter cable, which are easily disconnected or connected. The whole installation less the fillet and cowling comprises a single unit easily handled by one person and, since the fuel tank is built into the monocoque structure, fuel connections to the airplane are unnecessary. The overall weight and performance anticipated on the test airplane with and without the engine installed are shown below. The weight with fuel and oil is 80 lb.

	Without Engine	With Engine
Normal Gross Weight	530 lb	610 lb
Wing Loading	3.18 lb per sq ft	3.59 lb per sq ft
Minimum Sink	2.8 fps	3.2 fps
Gliding Ratio	19 to 1	18 to 1
Stalling Speed	28 mph	32 mph

Stability and Control Characteristics of a Simplified Helicopter

By Charles M. Seibel,
Boeing Airplane Co.

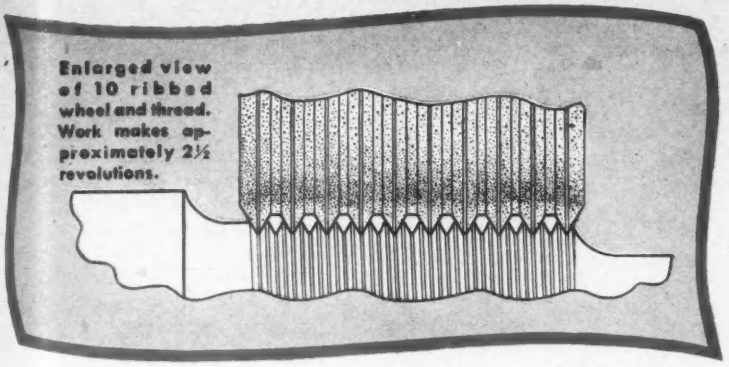
In the recent successful helicopter designs, the lateral and longitudinal control of the machine has been accomplished by the use of cyclic pitch changes on the rotor blades. In addition to the cyclic pitch systems, most of these helicopters are equipped with independent flapping hinges for each blade or with a see-saw hinge which operates as a flapping hinge for the two blades of a two bladed rotor. With either of these systems of blade attachment, it is impossible for a spanwise moment to be transferred from rotor blades to the drive shaft or into the rest of the machine. The chordwise blade moments are small in magnitude and will cancel between blades for hovering flight. Although these chordwise moments may cause forces in the collective pitch system, they have no effect on the lateral or longitudinal control system or on the machine as a whole during hovering flight. It is thus apparent that the latter and longitudinal control of these machines is accomplished primarily by changing the direction of the lifting vector of the main rotor. An application of cyclic pitch will incline the plane of rotation of the rotor blades, and since the lift vector remains substantially perpendicular to this plane, the lift vector will be inclined also. If the center of gravity does not lie on the rotor, which is the usual case, the relative position of the center of gravity and the lift vector will be altered thereby altering the balance of the machine. This change in balance produces the desired control.

Pursuance of this line of reasoning led to the conclusion that it makes little difference whether the left vector is moved to effect the control or whether the center of gravity is moved to effect the control. Identical control response can be expected as long as the relative positions of the center of gravity and the rotor lift vector are changed in the same manner.

In an attempt to study this problem further, a small flying model helicopter was built. The fuselage of this model was in two parts and interconnected by pin-ended links. One portion of the model fuselage was spring loaded forward and restrained by a control cord. The model was suspended on an arm in such a manner that it was free to move vertically, horizontally, and rotate in the plane perpendicular to the arm. Electric wires carried power along the arm to the electric motor in the model. The control cord traveled over a pulley at the model parallel to the arm, and then over a series of pulleys to a control stick. Motions of the control stick thereby cause relative motions between the two portions of the helicopter fuselage. This "arm" method of investigating helicopter control and stability has often been used successfully.

Initial flights made with this control arrangement proved to be very satisfactory. In fact, the control response was found to be better than had been anticipated from previous experience with helicopter models. Although the model was unstable in hovering flight and could not be flown "hands off" it was possible, with practice, to make successful flights by "over controlling" the bad stability characteristics. Problems associated with "feed back" forces from the rotor system were completely eliminated and a means of obtaining and adjusting the stick free stability of the machine was available. Aerodynamic and inertia forces in the rotor system could not be transmitted back to the pilot's control stick because the control stick was not connected to the rotor system but to the fuselage structure only. However, aerodynamic forces acting on the movable fuselage part would introduce stick forces. These aerodynamic forces on the movable fuselage part could be controlled and adjusted to provide any amount of apparent stability desired. With the center of gravity located several feet below the lifting rotor and with the effective fin area of the auxiliary rotor, the machine was very stable directionally and required little coordination to make satisfactory turns.

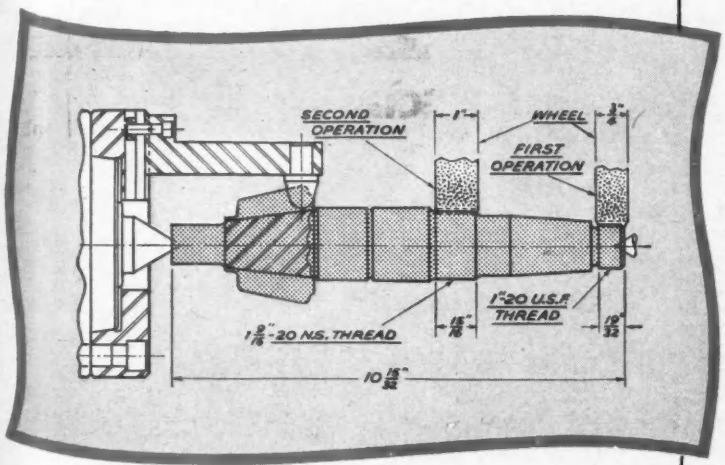
SPRINGS
Wire Forms • Small Stampings
Large and varied stocks of materials
Completely engineered production with laboratory control from start to finish.
Speedy automatics for large orders . . . Special department for small orders
Latest methods for uniform heat-treating
Super-vigilance in testing and inspection
Spring design help, no obligation
BARNES-GIBSON-RAYMOND
BGR
DIVISION OF ASSOCIATED SPRING CORPORATION
TWO PLANTS FOR SPRING SERVICE
DETROIT 11, MICHIGAN
ANN ARBOR, MICHIGAN



HERE'S *Production* THREAD GRINDING . . .

Ground from the Solid in *15 seconds*

1"—20 N.S. THREAD, GROUND FROM THE SOLID



ON AXLE DRIVE PINIONS

JONES & LAMSON AUTOMATIC THREAD GRINDERS

"PRODUCES NEAR PERFECT THREAD"

"EXPENSIVE HAND DIE OPERATIONS ELIMINATED"

"NO MARRED THREADS ON THE ASSEMBLY LINE"

"WHEEL COST PER PIECE LESS THAN THREAD HOB AND CHASER COST"

The Timken Detroit Axle Company, prominent manufacturer of heavy truck axles, has this to say about a Jones & Lamson Automatic Multi-Ribbed Thread Grinder installed to grind the threads on axle drive pinions.

"The threads are machined as a last operation following heat treat and grinding of all bearing diameters and prior to lapping. The machine produces a near perfect thread and eliminates all expensive hand die operations along the line and overcomes marred thread on the assembly line".

". . . the grinding of threads also reduces direct labor costs and indirect cost of cutting tools and equipment".

Jones & Lamson Automatic Multi-Ribbed Thread Grinders offer remarkable opportunities for economy with better quality in the mass production of threaded parts. Ask for one of our engineers to tell you more about multi-ribbed production thread grinding.

JONES & LAMSON MACHINE COMPANY, Springfield, Vermont, U. S. A.

Manufacturer of *Automatic Thread Grinders* and Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies

Torque Measuring Device Utilizes Compressed Air

(*Continued from page* 41)

vide a chart recorder. Reversed operation has been obtained by the use of a reversing-link mechanism.

For use in engine testing, where the measurement of engine-friction torque in one direction is only to 10 to 20 per cent of the torque in the opposite direction, a very satisfactory and simple arrangement has been to unbalance the dynamometer to the extent of the maximum friction torque so that a undirectional force is incident on the diaphragm regardless of the direction of the engine torque. The disadvantage of this arrangement is that the lower fifth of the manometer is used for reversed-torque indication and the manometer tube must be lengthened for a given torque.

The device can be made double acting by using a small diaphragm seal around the stem and by a suitable arrangement of pilot valve and connections to the air chamber above the diaphragm. During reversed operation the dynamometer force puts the stem in tension and is resisted by air pressure above the diaphragm. The double-ported pilot valve has provisions for operating both sides of the diaphragm and, with suitable tubing, connects air pressure to either side and opens the opposite side to the atmosphere. Similar reversed action can be obtained by connecting the under side of the diaphragm to a vacuum source through the pilot valve. When the force on the diaphragm is downward, compressed air is the resistant force and, when the force on the diaphragm is upward, atmospheric pressure is the resistant force.

Experience with the balanced-diaphragm torque indicator has shown good stability of calibration. A change in the relationship of pilot valve and diaphragm, however, requires a new calibration unless care is taken to accurately reproduce the initial setting. This setting is accomplished on the apparatus by adjusting the screw at the center of the diaphragm. This procedure is not necessary in order to obtain an accurate calibration, but it does permit reproduction of a calibration if the adjustments become altered. Reproducibility of calibrations has been found to be practically independent of vibration and of a vibrating load.

Self-energized oscillation, or hunting of the diaphragm, has been observed during some conditions of operation. This condition has been encountered only with diaphragm assemblies that have been operated with pressures that require mercury manometers. Hunting was eliminated by placing a needle valve between the pilot valve and the diaphragm. No trouble has been experienced with hunting in the water-manometer range provided that low air pressures are supplied to the pilot valve. In general, the air pressure should be maintained at a value just sufficient for the fully loaded condition. Experiments have shown that a considerable variation in the supplied air pressure has no appreciable effect on the calibration.

If you have a SPECIAL PROBLEM
in any of these operations, where precision work is demanded and where greater production at man-hour savings is paramount—
• BORING—rough, semi-finish and finish • MILLING (special types) • STRAIGHT LINE DRILLING • UNIVERSAL ADJUSTABLE SPINDLE DRILLING • HONING • TAPPING • REAMING • COUNTERBORING • VERTICAL AND WAY-TYPE EQUIPMENT . . .
then a Moline Multiple Spindle Specially Designed machine tool is your answer. Moline tools are ruggedly built and engineered to fit your PARTICULAR requirements, they're made to last for years, they're easy to change over to other jobs, they do better work at less cost and stand up to it longer.
For YOUR special problem, go "HOLE-HOG," write us for any information you may need.
MOLINE
MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS
MOLINE TOOL COMPANY
100 20th Street Moline, Illinois

WILLIAMS
DROP-FORGINGS
ANY SHAPE · ANY MATERIAL · COMPLETE FACILITIES
Write for Free Forging Data Folder . . . Helpful, Informative
J. H. WILLIAMS & CO., "The Drop-Forging People" BUFFALO 7, N.Y.

Classified Advertisements

1937 CITROEN frameless car. Front drive, torsion bar suspension, wet sleeves, etc. Who wants it for $900? Larson, 14 East 30th St., New York 16, N. Y.

AIR HAMMERS—DRILLS—INGERSOLL RAND MODEL AVC-11 PNEUMATIC RIVETING HAMMERS. RIVET SIZE 5/32" ALUMINUM PISTOL GRIP HANDLE. REGULAR PRICE $56.00. OUR PRICE $22.00, SLIGHTLY USED GUARANTEED LIKE NEW. IN LOTS OF 10 OR MORE 20% DISCOUNT. AIR DRILLS INGERSOLL RAND TYPE OJ MULTI-VANE 2250 RPM CAPACITY ¼" WITH #7B JACOBS CHUCK ALUMINUM PISTOL GRIP. REGULAR PRICE $66.00. OUR PRICE $32.50. GUARANTEED LIKE NEW. IN LOTS OF 10 OR MORE 10% DISCOUNT. SOLD WITH MONEY BACK GUARANTEE. C. & M. EQUIPMENT CO., 1831 S. STATE ST., CHICAGO 16, ILL. PHONE VICTORY 4344.

NEOPRENE SHEETING 1/16" and ⅛", neoprene strip ½" width, transparent vinylite tubing, sponge rubber pads, rubber cement 3M EC-711, hydraulic oils, rust-proofing oils. Offered at less than 50% market value to move surplus stocks. Montgomery Engineering Co., 1325 Broadway, Detroit 26, Mich.